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A Combination of Mayors

The movement inaugurated by the mayors of several cities for a conference of municipal officials to consider public utilities appears to be rooted in the old idea of "home rule." The Mayor of Chicago, one of the four city officials whose names are given in the call issued by Mayor Blankenburg of Philadelphia, has been a faithful, if disappointed, advocate of home rule. He did not want to have state regulation of public utilities in Illinois interfere with the regulation of Chicago utilities by that city. He wanted the city to have all the power over utilities within its borders. This policy would have thwarted the entire theory of state regulation in Illinois. It was rejected and the establishment of a state commission followed. In most other localities state regulation has supplanted city regulation. In our opinion the reason why this is so is that state regulation is better for the interests of the people as a whole than is city regulation. To the extent that the proposed combination of mayors tries to weaken the power of state regulation it will be an undesirable organization. The public desire at this time is for state regulation, and every opportunity should be given to test the ability of this power in government to solve fairly the problems between companies and public. To the extent that the mayors combine merely for the purpose of presenting the interests of their constituents fairly before commissions and of seeking by proper non-political means all of the facts in reference to public utility properties the combination will work toward a desirable end.

Legislation and Prosperity

President Wilson has reiterated his determination that there shall be trust legislation at this session of Congress. If it be true, as he believes, that this is all that the country needs to start it on the greatest era of prosperity in its history, let us all speed the day of trust legislation. We think that it can fairly be assumed that if trust legislation should heed the President's first specific reassurances to business the country need not be alarmed over the enlargement of governmental activities in regulation. It is also accurate to say that as a whole the early bills proposed in Congress were not at all in harmony with the calm, peaceful program laid down by Mr. Wilson. Either the Wilson economic discussion was a poor interpretation of the ideas of the lawmakers or the Congressional bills were a poor expression of the administration policy. The movement for regulation has progressed through the intervening troublous months until at the present time it is much nearer a final stage. An unfortunate thing about this period of doubt is that business men should have been allowed to think that their opinions were not wanted. The views of Mr. Brandeis, Mr. Untermyer and other self-constituted regulators of business have been sought and welcomed. So long as the views of business interests are expressed in the open the country has no cause to fear them. If it does not allow those views open expression, it encourages them to secret expression. It is a new doctrine that the regulated are too deeply concerned to be consulted about the method or degree of regulation. In spite of the limited expression of business opinion in regard to pending legislation it is greatly to be desired that the prosperous results pictured by the President shall flow from the laws. Certainly business interests want good business and will do what they can to further that end.

Decision in the Springfield Case

Like other early acts of new commissions, the decision of the Missouri commission in the Springfield case produces somewhat of a shock. In fixing a rate of return the commission bases its finding on the legal rate of interest in the State. The legal rate is applicable to loans. Loans are different from business enterprises. Even if the business enterprise is a public utility, its capital investment is not a loan. There is greater risk in investment than in loaning. It is necessary to pay for that risk in securing capital for investment in all trade and industry. No doubt there are places in Missouri where, notwithstanding the legal limitation of 8 per cent by contract, investigation would show that higher rates obtain. For instance, if notes were discounted on an 8 per cent basis the net full cost to a borrower would be higher than the 8 per cent named. The commission is acting summarily in its dealings with the holding company in this case. Charges made by a holding company to a subsidiary cannot be justified unless they are reasonable and for fair, full and plain value received, but it is idle to suggest that they may be availed of only in the event of inability of the local manager to meet a situation. That is equivalent to saying that a superintendent will not find it necessary, if he is competent, to consult a general manager; a general manager will not consult a president; a president will not talk with the chairman of the board, etc. Any holding company that is worth its salt can give needed and good advice to a subsidiary. As the company will ask for a rehearing of the case, there is a possibility of further review by the commission.

Some Recent European Railways

Looking over some records of recent achievements in electric railroading on the other side of the Atlantic, it is instructive to note the broad catholicity of view taken by Continental engineers with regard to ways and means of executing the work which falls to their lot. Unquestionably there are those among our foreign confrères who hold very strong opinions as to the best method for operating long electric lines, but the authorities who employ the engineers have not yet reached a frame of mind where they think it necessary because one method is good to regard all other methods as bad. On the Continent one finds in the same territory free use of all the traction methods that have been proved successful in practice, and while the exponents of each may regard the others as mistaken, there is no mutual recrimination to an extent sufficient to stop developments. Italy has long been an enterprising country in the matter of electric roads. If we remember correctly, it is a good many years now since the first American trolley line made fast its suspensions alongside St. Peter's. The Italian engineers—there are none more versatile—have kept up the good record in railway construction. In spite of last year having been one of relatively hard times in Italy, almost the usual amount of activity was displayed in electric traction, employing three-phase, single-phase and direct current where each seemed best to meet the requirements of the situation and the necessary connections. As our readers well know the northern group of electric roads centering about Milan is a three-phase group using about 3000 volts on the trolley wire with a standard periodicity of seventeen cycles. The system reaches from Venice on the east to Mont Cenis Tunnel on the west, and from Brig and the Simplon on the north to Genoa, and the complete network of lines is progressing rapidly toward electric operation, although not yet complete. Apparently everything has been working so smoothly within the last few years that for this particular work three-phase is to be used exclusively.

Further south, in the vicinity of Rome, the other systems come into their own, a considerable northern line extended last year being of the ordinary single-phase type with about 11,000 volts on the trolley wire at a frequency of twenty-five cycles per second. To the eastward, on the other hand, an important 1500-volt direct-current line is being extended. A part of this system was originally electrified with single-phase, a change having been made in method apparently on account of convenience in the matter of branches and connections rather than by reason of any functional troubles. Several other direct-current lines of similar character are under way. Thus active work is being done according to all three of the methods that have been found effective.

Another very interesting installation is being made in Sweden. It is practically the electrification of the mountain division of the international line which runs from the Gulf of Bothnia to the Atlantic, and the part electrified, the northernmost railroad in the world, extends from the Norwegian frontier very nearly 100 miles toward the east. This line is supplied with energy from a hydroelectric station with transmission voltage of 80,000 single-phase, the emf being reduced to 15,000 at fifteen cycles per second for the trolley wire. The line involves some formidable grades and sharp curves and will be operated by fifteen heavy electric locomotives. We mention this foreign work less because of its engineering interest, which is considerable, than to show the genuine activity in heavy electric traction and the broad view of the engineers who are responsible for the choice of methods.

Voltage Testing of Cables

It has been known for a long time to cable engineers that when a testing voltage is applied to an ordinary single-conductor cable of homogeneous insulation between the internal conductor and the external cover or sheath, the dielectric flux density is greatest at the inner wall of the insulator, that is, at the surface of the conductor. The flux density is clearly least at the outer wall of the insulator. Since the electric stress acting on the insulator, and tending to puncture it, is directly proportional to the electric flux density, it follows that the puncturing stress is always greatest on the inside and dwindles toward the outside. If the insulating material is homogeneous and free from flaws, it will therefore collapse electrically under unduly heavy stress on the inside surface next to the conductor.

If we suppose that the flux density at the inside layer reaches the break-down point, we may imagine that this layer collapses dielectrically and becomes conducting. When this happens the conductor becomes virtually enlarged and the insulator diminished in thickness. It might be supposed that since the original thickness of insulation gave way, the reduced thickness must next inevitably give way until the whole thickness collapses, but this is not true. If the conductor diameter was less than 36.8 per cent of the external insulation diameter, the electric collapse of the inside layer, if it occur symmetrically and not in radial streaks, will result in diminishing the internal stress. That is, the average stress and the average flux density will be increased by the reduction in the outstanding thickness of insulation wall, but the maximum stress and flux density on the inner layer of insulation will be lowered. If, however, the conductor diameter is greater than 36.8 per cent of the external insulation diameter, the collapse of the inside layer means increasing the flux density everywhere and should be followed by the collapse of the whole insulating wall. Consequently, when in a homogeneous insulator the conductor has less than 36.8 per cent of the external diameter the insulation may be overstressed on the inside and give way without breaking down the insulation as a whole. As Jona pointed out in 1904, there is experimental evidence for believing that such conditions are occasionally encountered.

The bearing of the above relations on the testing and design of transmission cables is pointed out in a useful paper by Messrs. W. I. Middleton and Chester L. Dawes, read at the recent A. I. E. E. convention. The authors hold up to merited ridicule the commonplace notion that the testing voltage of a cable should be in simple proportion to the thickness of the insulating wall. They also point out, with the aid of abundant oscillographic evidence, the importance of a sine-wave generator in testing all but very short lengths of insulated cable. Where the sine-wave form is deviated from, as is likely to be the case with transformers and powerful charging currents, the use of a peak-voltage voltmeter is distinctly desirable. An ingenious form of this instrument based upon the ordinary oscillograph is described in the paper.

The Status of Prime Movers

The report of the A. I. E. E. committee on prime movers submitted at the Detroit convention is an admirable compendium of the present status of prime movers for use on a very large scale. It deals essentially with the conditions met in central-station practice on a gigantic scale, and therefore is of special importance with respect to its outlook upon the great problems of centralized energy production which are now at last beginning to be dealt with properly. As regards small prime movers one must look elsewhere for full information. Indeed, it is fairly evident that the conditions as to relative economy of the various prime movers would be very radically altered in considering units, say, of 1000 kw or less.

The main feature of the report is the complete treatment of modern steam-turbine practice carried out on a very large scale, an excellent idea being given of what can be done with the recent generating units of from 10,000 kw up. We are inclined, however, to think that the figures put forth are somewhat optimistic in the sense that they represent the very best attainable practice rather than ordinary results. It is such improved conditions, indeed, that one must consider in thinking of the great power plants in the future. The most striking single item of information brought to the front is the very high thermal efficiency at present reached by the best and largest steam turbines, an efficiency exceeding 20 per cent of the value theoretically possible and quite surpassing the corresponding figures for any except the most economical engines of the internal-combustion type.

The committee points out that thermal efficiency is really the criterion of the performance, since the mere water rate depends so much upon the conditions of pressure, superheat and vacuum that it is difficult to make proper comparisons between tests of different units. However, by comparing performances under a standard condition of 175 lb. pressure and 100 deg. Fahr. super-temperature for 28.5 in. vacuum, the committee arrives at exceedingly instructive curves in terms of pounds of steam per kilowatt-hour and rating of turbo-generator. Taking the average results, a steam consumption of 14 lb. per kilowatt-hour is passed at an output rating of about 5000 kw, and 13 lb. is reached and barely passed only when the output approaches 30,000 kw. The fuel consumption, therefore, does not vary considerably with even a great increase in output rating of the turbine after a comparatively moderate figure is passed, a fact which should give good cheer to owners of stations of moderate output. Moreover, the cost per kilowatt, while of course less in the very large units, is not decreased to any very great degree, and one may fairly say that the advent of the large turbo-generator has given the medium-sized station a better chance for making records of economy than it has ever had before.

The report contains comparatively meager data as to the smaller turbines. For various reasons the results in the units of small output—say, 1000 kw and below—are not so favorable as are those reached with the large units of many thousand kilowatts. Indeed, in such minor sizes there seems to be very good evidence that better records for efficiency are held by reciprocating engines of the high-efficiency types. But the turbine seems to hold unquestioned supremacy over the very best that has been done with reciprocating engines when one considers outputs of 5000 kw and upward, so that the committee's statement that the reciprocating steam engine has become practically obsolete is entirely true for the class of work which it has chiefly in mind.

At the present time the highest thermo-dynamic efficiency is reached with the Diesel type of engine and the next with the gas engines using producer or natural gas. The efficiency curve of the very largest steam turbines is of the same general magnitude and indeed passes that of the ordinary gas engines. In turbines of no more than 1000 kw output the efficiency is distinctly lower, as might be expected. In spite of the fact that oil and gas engines, on the whole, have a large advantage in efficiency over the steam engines and turbines, showing a theoretical output duty of 1 hp per pound of coal or thereabouts, it nevertheless is held that the internal-combustion engines are not successful competitors of the best steam engines, either reciprocating or turbine, in the matter of the total cost of energy, because their cost and weight are relatively great and the repair bills decidedly high.

The facts are that a new plane of practical efficiency has been reached with the very large multi-stage turbo-generators of the present time, and, what is equally important, the cost of the prime mover per kilowatt of output rating has fallen so far below that reached by internal-combustion engines that the theoretical economy of the latter in fuel consumption becomes of no moment. The turbine has increased greatly in efficiency over the earlier units, but it is of even more importance that its price per unit of output has fallen from a high to a very moderate sum, so that its cheapness brings out an economic advantage quite as important as the saving in fuel.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Combination of Cities Against Public Utilities

Mayor Rudolph Blankenburg of Philadelphia has sent a letter to the Mayors of all of the principal cities of the country in which he says in part:

"The city of Philadelphia is preparing to bring, in the early autumn, before our new Public Service Commission, a case in which that body will be asked to pass upon a proper schedule of rates for electric light and power. We have come to realize that the side of the people has seldom if ever been adequately presented before other public service commissions, while the interests of the public utility companies are presented and argued by the best informed and most able men in the country. If the cities do not join together for the presentation of their cases as the public utility companies have, the laws and precedents established by the commissions stand in danger of being biased by the able arguments of the representatives of these corporations.

"The equipment required for an adequate presentation of the rights and interests of the people involves a degree and extent of technical knowledge and information which it is not practicable for any one city to obtain. This knowledge and information is much the same for each city, and its cumulative use would greatly add to its value. It must be borne in mind that the utility companies constitute themselves an offensive and defensive alliance, probably stronger than any other interest in this country. Its weakest member is never without information and assistance of every kind.

"To meet this situation it has been suggested that there should be formed a Bureau of Public Utilities Research which shall equip itself to give to the cities the same able assistance which the public utility companies' associations give to the public utility companies, thus in effect constituting an offensive and defensive alliance among the cities similar to that existing among public utility corporations."

It is proposed to hold a conference of city officials in Philadelphia in the autumn to discuss the matter. Mr. Blankenburg says that Mayor Mitchel of New York, Mayor Harrison of Chicago, Mayor Baker of Cleveland and Mayor Shroyer of Dayton join him in the matter.

Electrical Research at Massachusetts "Tech."

According to a statement issued last week by the research division of the department of electrical engineering, Massachusetts Institute of Technology, the following investigations are now either under way or in immediate prospect: An extended study of the effect of the length of ride on street railways upon the return upon the investment, requiring five years for completion according to present estimates; an analysis of the cost of delivery service in a large department store in New York City; a study of skin effect in solid and stranded conductors when carrying high-frequency currents; a high-accuracy analysis of sound waves; a study of core losses in electrical machinery; a study of forced and free vibrations of loaded and unloaded telephone diaphragms; a study of transient electrical phenomena in a 750-mile artificial transmission line, and a measurement of rail resistance to alternating currents up to sixty cycles. A final report upon the cost of motor and horse traction on highways will probably be completed early this summer. Nine research associates and assistants will shortly be exclusively occupied in the work of the research division, more than $20,000 being available for this work during the next year.

Engineering Society Prizes for Students

The Engineers' Society of Western Pennsylvania, Pittsburgh, Pa., has awarded prizes in its first annual competition among students of technical schools of collegiate rank. The competition involved the solution of problems in the fields of civil, electrical and mining engineering. In the electrical engineering competition the problem was the design of a 30,000-volt transmission line and substation. Data were given for the daily load curve, required voltage, supply voltage, phase and frequency, and length of transmission. The answers were judged with regard to judgment, method, accuracy and neatness. Although the competition was limited this year to a few schools, the society was so satisfied and encouraged with the results that it has been decided to open the competition in the future to all engineering schools which care to enter.

The first prize was this year awarded to Mr. John R. Lainbach, of the Georgia School of Technology; the second prize to Messrs. F. C. Gaines and Millard C. Howe, of the same institution, and the third prize to Messrs. Frank Fischer and F. H. Graham, of Pennsylvania State College.

Society for the Promotion of Engineering Education

The twenty-second annual meeting of the Society for the Promotion of Engineering Education was held at Princeton, N. J., from June 23 to 26, 1914. The proceedings cover a wide range of subjects, but the central idea brought out was that emphasis should be laid upon fundamental principles, and that education is not so much a matter of administration as of purpose and spirit. The meeting was notable because of the attendance of official representatives of a large number of educational institutions. Institutional membership is a new feature of the society organization inaugurated during the past year. Its purpose is to make the findings of the society more immediately applicable to the educational life of the country. The institutional delegates were very enthusiastic in regard to the possibilities of this new feature of the society activity.

The following elections were made on the last day of the conventions: President, Dean Anson Marston, of the division of engineering, Iowa State College, Ames, Ia.; vice-presidents, Prof. Henry H. Norris, formerly of Cornell University, now associate editor of the *Electric Railway Journal*, New York, and Dean C. Russ Richards, of the college of engineering, University of Illinois, Urbana, Ill.; secretary, Dean F. L. Bishop, of the school of engineering, University of Pittsburgh,

Pittsburgh, Pa.; treasurer, Mr. William O. Wiley, of John Wiley & Sons, New York; members of the council, Messrs. R. H. Fernald, professor of dynamical engineering, University of Pennsylvania, Philadelphia, Pa.; A. H. Fuller, dean of the college of engineering, University of Washington, Seattle, Wash.; A. M. Greene, Jr., professor of mechanical engineering, Rensselaer Polytechnic Institute, Troy, N. Y.; E. V. Huntington, assistant professor of mathematics, Harvard University, Cambridge, Mass.; Vladimir Karapetoff, professor of electrical engineering, Cornell University, Ithaca, N. Y.; B. C. Miller, professor of physics, Cass School of Applied Science, Cleveland, Ohio, and W. M. Riggs, president of the Clemson Agricultural and Mechanical College of South Carolina, Clemson College, S. C.

The reports of the various officers showed that the society is in a flourishing condition, the individual membership now being nearly 1400 and the institutional membership about fifty. The council recommended that the 1915 meeting be held in the Middle West.

Westinghouse Strike Situation

A company of the State Constabulary of Pennsylvania went to East Pittsburgh on June 29 for the purpose of assisting in the maintenance of order in the district affected by the strike of employees of the Westinghouse Electric & Manufacturing Company. The State Constabulary were sent at the request of Sheriff Richards, of Allegheny County, made after a demonstration by strikers which threatened disorder.

Employees of the Union Switch & Signal Company who walked out on June 12 have returned to work. Mr. H. G. Prout, president of this company, in announcing that all the men had returned to work said: "This walkout was an Industrial Workers of the World effort thinly disguised, and the men went out without presenting any grievances, demands or requests. No concessions whatever have been made by the company."

The Electric Vehicle at Boston

At the annual field day of the Electric Motor Car Club of Boston, held at the Kennel Club, East Braintree, Mass., on June 23, President Day Baker pointed out that there are now two important "load centers" of electric-truck service in Boston. One of these consists of the territory within about one-half mile radius of the South Station, and the other is in the Roxbury district. In the former there are now operating forty-two trucks of from 1000 lb. to 3.5 tons capacity, all used in express service; two 5-ton trucks for handling freight in broken lots at the New York, New Haven & Hartford terminal; three 5-ton ice-handling trucks for the Commonwealth fish pier (mentioned in the *Electrical World* of June 27, page 1512); nine 5-ton trucks used in hauling coal, gasoline, sugar and confectionery, and eighteen other trucks operating in a varied service, conspicuous features of which are the delivery of chocolate almost daily in 14-ton shipments, wholesale milk distribution, coffee delivery, provision handling, etc.

In the Roxbury district the Boston Edison company garage is the operating center for eighty-two electric trucks owned by the company, including machines ranging from light delivery wagons to those of the 5-ton truck type, and twenty-four patrol and department vehicles. Twenty-two other trucks are in service in this district, seventeen being in the brewing industry. Others include a hospital ambulance and a small electric truck for making quick deliveries of hot food to patients remote from the kitchen. Nearly 175 trucks are in service in these two centers, with the prospect of further development in the near future.

The Inventor at Play

At the third annual field day of the Edison interests, held at Olympic Park, Newark, N. J., June 25, Mr. Thomas A. Edison took an active part in the sports of the day. Despite his sixty-seven years, "the Old Man" opened the baseball game by gleefully tossing the first ball across the plate and afterward took his place in the judges' stand for the electric automobile races. Nearly

MR. EDISON PITCHING THE FIRST BALL

2000 Edison employees and their friends attended the field-day exercises. Mr. R. A. Coe won the cup presented by Mr. R. A. Bachman, vice-president of the Edison Storage Battery Company, for the best all-'round athlete.

Electrical Activity in California

At a prosperity dinner given in San Francisco on Monday night of this week Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, showed wherein public service corporations have contributed to the material welfare of the State. In all communities, he said, there are two main factors—namely, transportation and lighting and industrial motor service—the success of which marks the success of the community and its people. Of primary importance is the matter of transportation. Second only to that is the matter of the distribution of energy for lighting, heating and motor service. As concerns prosperity, it may be said that the steel rails of the transportation companies which gridiron a state parallel the transmission lines which convey electrical energy. Both enterprises are large employers of labor, and by the distribution of a large portion of their earnings to the masses employed many other industries and other lines of business are encouraged.

It is on record in the State Treasurer's office at Sacramento that there was contributed by these two enterprises to the State of California as taxes for the year 1913 a total of $8,259,001.84, which represented a gross earning of these corporations of $174,954,000, the tax being based on a payment to the State of 4.6 cents on each dollar earned.

The total income derived by the State of California from electric-service companies was $1,941,326, representing an income of $42,082,534. According to Mr. Britton, these companies expended for operation of their plants during the year 1913 approximately $24,000,000 and expended in betterments of the plants approximately $20,000,000, making a total of $44,000,000.

Statistics of various power plants in California show that for every dollar expended either for operation, maintenance, repairs or new construction about 40 cents is used for labor. It is therefore certain that the electric-service companies expended for labor in California during 1913 $17,600,000 and expended at least $10,000,000 more in the purchase of material and supplies, thus forming the never-ending chain of money circulation.

In reviewing the six months of 1914 just passed there is no reason to doubt that the same ratio of revenue and expenditures will continue; in fact, the balance sheets of the companies show an increased revenue.

The wages paid to laborers in California in the electric-service industries, as shown in the report of the United States Census Bureau, are in excess by 34 per cent of the wages paid in all other parts of the United States for similar labor. This fact has a marked effect on the prosperous condition of other enterprises.

From United States census reports, California ranks first in the horse-power installed per capita, there being one-third of a horse-power for each person, or a total of 800,000 hp. The rates paid by the consumer are lower than in all other states but one, Nevada. Compared to Wisconsin and Massachusetts, the nearest competitors in agricultural pursuits, the average rate per horse-power-hour in California is 2 cents, in Wisconsin 3.9 cents, in Massachusetts 5.6 cents.

Salem (Mass.) Central Station Survives Conflagration

A conflagration resulting in an estimated loss of $10,000,000 occurred at Salem, Mass., on the afternoon and evening of June 25. The fire rendered about 20,000 persons homeless and consumed approximately 1000 buildings, sweeping the shoe and leather district and many residential streets. Early in the evening the city was placed under martial law, and although dynamite was freely used to check the flames, strong and shifting winds carried the fire over an area about 1.5 miles long by 0.5 mile wide.

The loss of life was fortunately small, as ample warning was given in nearly every case of the approach of the flames. Many of the principal factories were wiped out, including the large mills of the Naumkeag Steam Cotton Company, the employer of 2000 hands and the largest customer of the Salem Electric Lighting Company, which supplies the electrical service of the city. The lighting company lost its office building and storehouse, while its general manager, Mr. S. Fred Smith, a past-president of the New England Section of the N. E. L. A., lost his home, as did a number of other employees of the company.

Employees Remain in Station Surrounded by Flames

Early in the evening it became necessary to open the various electrical distribution circuits of the company as the fire swept across the city, and this fact gave rise to the report that the company's 4500-kw turbine plant on South River had been destroyed. The station magnificently met the test, however, and, aside from a burned coal conveyor, remained unharmed although the fire attacked the building on all sides. The Salem company is one of the Tenney properties, the headquarters of the general management being in Boston.

About two years ago this station was reconstructed under the direction of Mr. F. C. Sargent, head of the engineering department of the Tenney syndicate, special attention being paid at the time to the question of fire protection. The walls of the plant are of brick, about 1 ft. thick; all windows are of wired glass, and all but two of the doors are of fireproof construction. The roof is of tile. Five employees courageously remained in the station as the flames closed in upon it, shutting every possible opening to the outer air, and manning the hose lines. As the heat increased, water was played upon the two wooden doors. The city water pressure fell from a normal of 50 lb. to a minimum of 7 lb. during the fire, but the faithful corps within the plant kept up steam in the boilers, and although the turbines had been shut down, as there was no longer any load to be carried, an exciter was operated at normal voltage throughout the entire period.

The conveyor belt caught fire and carried a slight blaze into the overhead bunker, but this was extinguished by the men within the building. The latter

SALEM POWER HOUSE AFTER THE FIRE

were subjected to severe heat and much smoke. Many sparks were blown into the building through cracks by the heavy draft of the fire. The flames finally passed the building and by 1 o'clock on the morning of the 26th the national colors were run up the staff amid the cheers of thousands of spectators, the flag being seen as clearly as at noonday in the light of the nearby burning buildings.

A view of the station, unscathed except in the loss of its coal conveyor, but surrounded by ruins, is shown herewith. The company garage is seen at the left, below the conveyor and at its rear. This garage also went through the fire safely.

Restoring Service to the Stricken City

Before the fire was over the local officials of the company and other officers and employees of the Tenney companies were taking steps looking to the resumption of service on the distribution system. All the mains connecting the plant with the various centers of distribution were cut off by the fire, and the problem of reconstructing temporary connections was at once taken in hand. The Boston Edison Company, the Lynn Gas & Electric Company, the Beverly Gas & Electric Company, and practically every other central-station organization in eastern Massacushetts, offered all possible assistance, and on the morning after the fire a large force of linemen was at work installing temporary mains and poles.

On the night of the fire candles were sold at $1 per

dozen, but on the evening of the following day street-lighting service was resumed on six circuits in the down-town section and two lines supplying commercial lighting and a limited amount of residential service were in operation, and by the second night the company was handling substantially all the service which its remaining customers called for.

A large tent erected in the former storage yard at the side of the station served as a commissary. About 40 miles of new wire of from No. 6 to No. 0 size was erected to connect the station with the unharmed districts of the city, and the work of rehabilitation included the removal of injured portions of the overhead equipment which might interfere with the service. A temporary office was opened by the company at 72 Washington Street, Salem, in the retail business district, which escaped the conflagration. The ability of the station to withstand the conflagration was of immense value to the community.

The Fire's Effect on Other Electrical Interests

The Bay State Street Railway Company, which provides all the trolley service of the city, escaped with the loss of a portion of its overhead system. The local office of the New England Telephone & Telegraph Company was not injured, but telegraph operators were obliged to transfer their work to Beverly.

The firm of Stone & Webster, Boston, has contributed $5,000 toward the relief fund, and it is doubtful if any event in New England electrical circles has done so much to vitalize the spirit of co-operation as this visitation upon the famous old city of Salem.

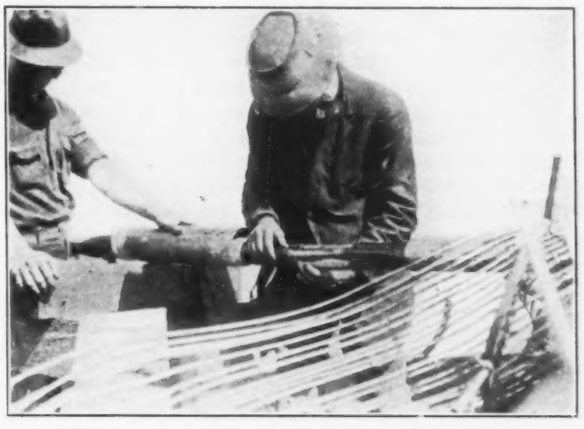
Laying Transmission Cable Across San Francisco Bay

The Great Western Power Company has heretofore brought energy from Oakland substations to supply its San Francisco distributing system by means of a single 11,000-volt cable that crosses beneath the bay separating these two cities. Recently the service supplied by the company in San Francisco has increased enough to warrant the laying of a second cable, parallel to the first, and designed for a normal loading of 6000 kw. An unusual feature in the placing of the second cable was that the contractor furnished a bond for the satisfactory performance of the work, guaranteeing that when in place the cable would withstand for five consecutive minutes a 30,000-volt difference of potential between conductors, or 22,000 volts between any one conductor and ground. The contractor was also made responsible, under the bond, for the "perfect operation" of the cable at 11,000 volts for a period of sixty days after it was put in service.

The actual submerged length of the cable is 20,500 ft., but shore connections brought the total length laid up to 21,300 ft., of which 1350 ft. at each end was of 300,000-circ. mil section and the remainder 250,000-circ. mil. The cable consisted of three stranded copper conductors each insulated by 6/32 in. of 30 per cent Para rubber, over which was wound 2/32 in. of varnished cloth. Spaces between conductors were filled with jute and insulating compound, and all three were wrapped together in a 5/32-in. varnished-cambric belt. Over this was a 5/32-in. lead sheathing wrapped in jute and armored with No. 4 B. W. G. galvanized-steel wire with a "lay" of about 3 ft. This cable was 4 in. in diameter, weighed about 23½ lb. per foot and was delivered by the General Electric Company on reels that contained 1358 ft. each.

The method of laying the cable was first to tow over the proposed route a barge from which was paid out a 1⅛-in. messenger cable, this being placed exactly and the necessary amount of slack determined by subsequently underrunning it with the same barge. Reels of the high-voltage cable were then loaded on the barge and the messenger cable was once more underrun, this time the cable being paid off the reels and lashed to the messenger cable so that the two thus connected would be paid out continuously over the course. Every 20 ft. the cables were lashed firmly together with No. 6 B. W. G. steel wire, a light wrapping of the same wire following along between lashings. This method, which involves leaving the messenger cable on the bottom with the transmission cable, has been patented by Mr. A. J. Pahl. A launch was used to tow the barge, and the latter was stopped and held firmly at any point desired by locking the messenger cable to the barge. This was accomplished by an ordinary cable-railway grip solidly attached to the barge just above the messenger cable.

It was found that a 30-ft. by 75-ft. barge would carry four 1350-ft. reels of the cable mounted on axles and would also afford ample working space for splicing, etc. A 40-hp gasoline launch was all that was required



JOINING THE CONDUCTORS

in towing. The paying out of the cable progressed at the rate of 1350 ft. in about four hours. When the end of a reel was reached the barge was held in place by the grip while a splice was made. When all the reels were empty a cap was soldered on the end of the cable, and this was carefully lashed to the messenger and paid out as before. The messenger was then underrun by the barge until shore was reached, when a set of full reels was substituted for the empties. With its new supply of cable the barge was run back under the messenger until the cable end appeared, when a splice was made and the laying continued.

In all fifteen splices were made on the barge. These involved exposing the copper conductors for a length of about 1 ft. on each of the ends to be joined and connecting them under an insulation of 30 per cent Para rubber equal to that on the remainder of the line. A 4.25-in. lead sleeve 0.25-in. thick was used and joints were filled with insulating compound. Jute was placed over the sleeve and the wire armor was lapped for about 3 ft.

The work occupied about thirty days, including delays. The contract was signed April 8 and the successful test of the cable at 30,000 volts was made by the transmission company on June 19. The cable was placed in regular service on June 20, when it was connected in parallel with bay cable No. 1 to carry the city load. The average crew totaled about ten men exclusive of those manning the launch chartered for the job. The contractor was A. J. Pahl, of the K-P-F Electric Company, San Francisco.

Canadian Electrical Association Convention

One of the most enthusiastic conventions in the history of the Canadian Electrical Association was held in Montreal June 24, 25 and 26, with a registration of more than 400. The sessions were held in the new Ritz-Carlton Hotel.

Col. D. R. Street, the president, opened the initial meeting of Wednesday, and on behalf of the Mayor of Montreal Alderman Leslie Boyd welcomed the delegates to the city. President Street then reviewed in a general way the work of the association for the last year, which he declared to have been a hazardous one in its history.

President Street's Address

At the outset of 1913, said Colonel Street, the association found itself without a secretary and with considerable disaffection in its ranks. Some of the members had felt that municipal plants should be taken into membership, some of the manufacturers desired the full privileges of Class A members, and others seemed to feel that there was no special advantage in belonging to the organization. Mr. J. H. Larmonth, of Toronto, was about this time obtained as permanent secretary and began a study of the electric plants in Canada which showed there to be 364 privately owned stations and 174 municipal plants in the Dominion. Of the privately owned plants only fifty-four were Class A members, but these represented a capitalization of $110,000,000 and had an aggregate annual pay roll of $2,000,000. Other personal interests then compelled Mr. Larmonth to resign, and Mr. Allan Sullivan was in turn appointed to the position, for which, said Colonel Street, he is extremely well qualified.

The president then pointed out several matters that should receive attention from the incoming executive: (1) Obtaining, if possible, public-service commissions in several provinces. (2) Keeping in touch with all legislation affecting central stations. (3) The formation of an association statistical department. (4) Closer study of the question of insurance. In closing, Colonel Street expressed his appreciation of the benefits to be obtained from Canadian affiliation with the National Electric Light Association.

Report of Secretary Sullivan

The secretary's report, presented by Mr. Allan Sullivan, reviewed the strength, both financial and physical, of the central-station interests of Canada. Secretary Sullivan particularly urged an increase in the number of Class A members. He divided the work of the association into two general classes: First, that of accumulating and classifying statistics, and, second, the psychological function of influencing the minds of men. This latter point he further elaborated with respect to the idea of molding public opinion and strengthening the bonds between the public and the public-service corporation.

The National Electric Light Association was represented by Mr. T. C. Martin, executive secretary, who presented the congratulations of Mr. H. H. Scott, the new president. Mr. Martin in reminiscent humor recalled the early years of the N. E. L. A. and the first electrical exposition, which was held at Philadelphia some thirty years ago, having been preceded by an international meeting of electrical engineers in Montreal.

The committee on rates submitted its report, which was read by Mr. J. C. Wills, representing Chairman W. S. Robertson. The report included a list of Canadian electric-service companies with their rates for service and discussed the desirability of standard forms of contract and uniform terms and conditions. In view of the keen competition existing in some localities the committee proposed drawing up only a confidential list of rates, to be supplied to Class A members only. The committee also recommended the adoption of a demand rate based either on a five-minute continuous-demand peak with the alternative of 80 per cent of the momentary peak, or, secondly, on an integrated twenty-minute peak with the alternative of 70 per cent of the momentary peak.

The commercial committee reported progress.

Mr. A. A. Dion, chairman of the meter committee, stated that steps are being taken to test the various demand meters manufactured in America and in Europe and to investigate the question of current limiters for small-residence service. The committee will also take up with the Bureau of Weights and Measures the question of standardizing Canadian meters.

The interesting report of the committee on standardization of line construction was presented by Mr. S. B. Hood, its chairman. The report covered in detail the construction of lines for pressures up to 35,000 volts, and it was accompanied by thirty-five drawings. A new method of cross-arm bracing, which is mechanically more correct than some of the older methods, was also featured.

Electrical Development for Canada

The Society for Electrical Development was represented by Mr. J. M. Wakeman, general manager, who came, as he stated, preaching co-operation. "What the Society for Electrical Development Can Do for Canada" was the title of Mr. Wakeman's address of Thursday morning. The society, he said, now numbers more than 1300 members, has its initial $200,000 pledged, and is starting active work. Its representatives will travel through the country, forming local electrical leagues and rendering central stations such aid as outlining and inaugurating new-business campaigns. A traveling engineer will also be maintained to investigate the use of electricity in various industries. A campaign of national advertising has been begun, and moving-picture films depicting the advantages of the domestic use of electricity have already been arranged for.

Governmental Meter Inspection

Mr. Ormond Higman, chief electrical engineer of the Department of Inland Revenues, also addressed the convention informally on the general question of governmental meter inspection. He stated that in 1908 33,000 meters were tested and in 1913 approximately 150,000. Branch testing laboratories are now under construction at Vancouver and Winnipeg. In reply to a question by Mr. D. H. McDougall, of Toronto, Mr. Higman stated that approximately 500 corporations are registered as electric-light companies in Canada, representing an investment of approximately $300,000,000. Replying to Mr. A. A. Dion, of Ottawa, the speaker said that the question of standardization of meter connections, dials, etc., is receiving the attention of the department, which is sending to manufacturers blueprints showing acceptable dials and recommending to them that meter connections enter at the left and leave at the right. In connection with the duration of demand peaks the department has made no definite rulings as yet, but does not look favorably on any demand of less than ten minutes. This would not hold for such wholesale energy as is sold at Niagara, but refers to small customers only. Mr. A. L. Mudge, of Toronto, suggested that several peaks be standardized for various classes of service.

Election of Officers

The executive session was attended by Class A members only and was not a public session. The officers elected for the coming year were as follows: President, Col. D. R. Street, Ottawa; first vice-president, Mr. D. H. McDougall, Toronto; second vice-president, Mr. R. M. Wilson, Montreal; third vice-president, Mr. Wills Maclachlan, Toronto; honorary secretary, Mr. T. S. Young, Toronto; secretary and treasurer, Mr. Allan Sullivan, 610 Confederation Life Building, Toronto; managing committee—Messrs. W. G. Angus, Hamilton; Robin Boyle, Niagara Falls; P. T. Davies, Montreal; A. E. Dunlop, Pembroke; J. S. Gould, Smith's Falls; G. Radcliffe Hulme, Montreal; George Kidd, Vancouver; G. W. Magalhaes, Toronto; H. R. Mallison, Montreal; H. G. Matthews, Quebec; Earle L. Milliken, Sydney; J. S. Norris, Montreal; L. W. Pratt, Hamilton, and W. S. Robertson, Toronto.

The association passed a resolution making the president of the N. E. L. A. a member ex officio of the managing committee. The N. E. L. A. was represented at the executive session by Messrs. T. C. Martin, F. C. Henderschott and W. H. Blood, Jr. At the executive session there was also presented a report on the work done during the past year by the N. E. L. A. street-lighting committee, of which Mr. Wills Maclachlan, who presented the report, was a member.

Abstracts of the papers presented at the Montreal convention, together with the discussion which followed, have been withheld from this issue for lack of space but will appear in a later number.

Progress of Trust Legislation

The steady grind of debate on the trade commission bill began in the Senate on June 29, with every prospect, according to Senate leaders, that anti-trust legislation will be under consideration in the Senate now for six weeks.

The trade commission bill has now been made the "unfinished business" of the Senate, which means that every day when the so-called "morning hour" ends at 2 o'clock the trade commission bill comes up.

The Clayton anti-trust bill, passed by the House, is still unfinished by the Senate judiciary committee. The railway capitalization bill is in the same condition in the hands of the Senate interstate commerce committee.

Just when these two measures will get to the floor of the Senate is a problem. The Clayton bill, which deals with interlocking directorates, holding companies, price-fixing, labor union exemptions from anti-trust laws and injunctions in labor disputes, has been remade and remade again and again by the Senate judiciary committee, some of whose members declare a number of the paragraphs of this bill to be unconstitutional. The fight in committee on this bill presages a greater fight on the floor of the Senate. The railway capitalization bill is now the subject of daily hearings before the Senate interstate commerce committee.

The Senate is far from resigned at the prospect of six weeks' discussion of anti-trust legislation. In view of the difficulties of the Senate judiciary committee in straightening out the Clayton bill, the proposed Democratic conference on anti-trust legislation has been postponed until that committee concludes its work. Reports from the home states of members of the Senate judiciary committee declare that in the case of communities where one or two men are directing nearly all the corporations of such communities the Clayton bill would upset those communities and benefit no one.

On the floor of the Senate a number of speeches have already been made, although the debate is proceeding with some interruptions. Senator Robinson has had read into the record, in connection with the unfair competition clause of the trade commission bill, instances taken from decrees of federal courts in cases arising under the Sherman act, namely, United States vs. American Coal Products Company, United States vs. General Electric Company and United States vs. American Thread Company.

Mr. Borah is leading the fight against the trade commission bill and has replied upon several days to Democratic Senators who have spoken for it. He began to speak on June 26 and concluded his arguments for the present on June 29. Mr. Borah said that passage of the bill would lead, not to certainty among business men as to what they may lawfully do, but to another period of uncertainty such as followed the passage of the Sherman law.

Decision in Rate Case in Springfield, Mo.

The Public Service Commission of Missouri made public its decision on June 24 in the Springfield Gas & Electric Company rate case. According to the abstract of the decision made public by the commission, it is found that a net return of 7 per cent is adequate for the company, and a reduction in rates amounting to more than 30 per cent is ordered. According to the calculation of the commission, this will have the effect of reducing the revenues approximately 37 per cent. The decision was written by Chairman Atkinson and Commissioner Shaw and was concurred in by Commissioners Kennish, Woerner and Wightman.

The company, it is announced, will file an application with the commission for a rehearing of the case.

The Springfield Traction Company and the Springfield Gas & Electric Company were the defendants in the case. All the stock of these companies is owned by the Springfield Railway & Light Company, a holding company of Maine, and all of the latter company's stock is owned in turn by the Federal Light & Traction Company, a holding company of New York.

On Feb. 8, 1913, a 6-cent maximum-rate ordinance was passed by the city of Springfield. On Feb. 17 a tripartite agreement was executed between the Springfield Railway & Light Company, the Maine holding corporation, and the Springfield Gas & Electric Company and Springfield Traction Company, transferring the steam-power plant to the Gas & Electric company for $388,416. This consideration was paid by entries on the books of the companies. Later the valuation of the steam plant was increased and a further book entry was made against the Springfield Gas & Electric Company, making a total consideration of $414,526. The commission holds that this attempted transfer was a palpable attempt to transfer a useless power plant from the unprofitable Traction company and unload it upon the prosperous Gas & Electric company and thus have its value amortized out of the earnings of the more prosperous company. The commission holds that the attempted transfer and sale while the rate matter was pending was a fraud upon the public and therefore void. In the subsequent consideration of the case this power plant is treated as the property of the traction company.

Evidence was introduced at the hearing to the effect that an up-to-date distributing system could be built at Springfield for $151,266. It was noted also that the assessed value of the entire property of the Gas & Electric Company for 1911 was $150,000, inclusive of the gas department. It was found, the decision says, that $500,000 stock and $277,000 bonds were

issued on property for which the secretary of the company testified $300,000 was paid. The assets of the Gas & Electric company as shown by the books are $865,713 for the electric department. The commission observes that no deductions for superseded property had ever been made by the company, and that, except for an item of $5,666, no depreciation had been deducted during twenty-nine years, and further that $60,000 is included as franchise values of the gas and electric property. The commission arrives at the conclusion that $270,000 is the corrected original cost of the electric department of the company, holding the amount for which the plant was transferred upon the books of the company, $414,526, to be entirely too large.

The companies claimed that the business had a distinct "going value" of between $60,000 and $137,900, based upon the earnings of the present plant. The commission holds that a distinction is to be made between a valuation of the properties of public utilities for the purpose of sale or condemnation and a valuation for rate-making purposes. The commission says that no proof was offered tending to show that the company suffered early losses, but that the record disclosed much evidence indicating that the early losses, if any, have long since been recouped through excessive rates, and that the alleged earnings have been from the electric department and the losses, if any, from the gas and street railway departments. It is the duty of the company to show by competent proof that losses have been incurred and, applying the distinction between sale and condemnation cases and rate-making cases, no separate and distinct item for going value is allowed in this case but the commission takes "into account the fact that the plant was in successful operation" in fixing the fair value for rate-making purposes.

The commission in arriving at the rate of return to be allowed states that 6 per cent is the legal rate of interest in the State and by contract the rate may not exceed 8 per cent, holding that 7 per cent is a just net return on property invested in public utilities. The rate of return must be determined from the facts of each case. For depreciation the commission makes an allowance of 5 per cent of the present fair value of the property.

In view of the fact that the Springfield Gas & Electric Company and the Springfield Traction Company have a contract with the Ozark Power & Water Company for electric energy and a supplementary agreement whereby the Ozark company agrees to furnish break-down service from the Empire District Electric Company, the contention of the complainants that no necessity exists for an auxiliary steam plant at Springfield is upheld, the evidence failing to convince the commission that any part of the steam plant at Springfield is used or useful for the public, and it is not taken into consideration in allowing a valuation upon which the return is to be based.

The opinion also states that the citizens of Springfield are entitled to good and adequate electric service and to receive the benefits of their natural location, if any there be, and should partake of the advantages in the reduction of the cost of hydroelectric energy.

In considering the salaries and commissions paid to the Federal company the opinion states: "We think, because of this situation [control by the Federal company through the Railway company of Maine] and the very human tendency of corporate greed of some holding companies to 'milk' the earnings of subsidiary companies through 'dummy' directors, that it is the duty of this commission to limit strictly the amount of any such charges, which shall be only for the services rendered by such holding company, to the lowest reasonable charge for the services actually rendered. . . . The public at Springfield is paying the salaries of a competent manager and a competent secretary of defendant companies who reside at Springfield, and we do not think that the public should be called upon to pay any other 'managerial services' or management by 'long distance,' from the New York office of the holding company in this case. No charge should be allowed for commissions, except for services actually rendered to the company, and that at no higher cost than the local company could employ the services of a competent independent engineer, provided that the manager in charge is not able and competent to render such service to the company himself. . . . We disallow any charge whatever for 'managerial services.'" Open, fair, arm's-length dealings, one with the other, is stated to be better in the end for interrelated corporations. The deduction of salaries and commissions takes $18,000 annually from operating expenses.

In conclusion, the commission finds that the fair present value for determining reasonable and just rates in this case of all of the property of the electrical department of the company, as of Sept. 30, 1913, is $300,000. The commission found the rates, for electric energy to be unjust and unreasonable and the schedule of rates in force to be unjustly discriminatory and unduly preferential, and declared that rates should be fixed upon a sliding scale with maximum prices for the various amounts of electric energy furnished.

The commission found that the operating revenue for 1913 was estimated at $185,900. It figured operating expenses, allowance for contingencies and depreciation and return on investment, as corrected, at $116,000, which in its opinion justifies a reduction of 37 per cent below the 1913 revenue.

Analysis of consumers' bills for September, 1913, discloses an average rate of 9.69 cents per kw-hr., an average motor-service rate of 5.5 cents and an arc-lamp rate of 5.8 cents. The following is the substance of the schedule of rates prescribed by the commission: Residence light, 8 cents per kw-hr. for the first thirty hours' use and 5 cents for additional use; general lighting, 8 cents per kw-hr. for first thirty hours' use, 5 cents for next sixty hours and 3.5 cents for further use; "large light and power," 7 cents per kw-hr. for first thirty hours' use, 4 cents for next thirty hours' use, 3 cents for next sixty hours' use and 2.2 cents for additional use; street lighting, $60 per inclosed arc lamp per year and $6 per incandescent 40-watt lamp per year. The minimum charges follow: Residence, 75 cents per month; general lighting, 5 cents per month for each 60-watt equivalent load with no charge less than $1; street lighting, incandescent light available only when arrangements have been made for the use of fifty or more lamps; "general power," 75 cents for each kilowatt of connected load; "large light and power," $1 for each kilowatt of maximum demand.

Removal of Mr. Weston from Chicago Board

Mayor Harrison of Chicago wrote to Mr. George Weston on June 23 removing him as a member representing the city of Chicago on the Board of Supervising Engineers, Chicago Traction. This action is the cumulation of a fight which has been waged by the Mayor against the board for a long time and is generally understood to be due to politics. The formal concurrence of the City Council was voted on June 29. Mr. Weston still holds his position as chief engineer of the board. Advices from Chicago say that Mayor Harrison will appoint Prof. Edward W. Bemis to succeed Mr. Weston as the representative of the city on the board.

Public Service Commission News

Missouri Commission

A decision has been rendered by the Missouri Public Service Commission in the case of S. W. Weaver vs. Kirksville Light, Power & Ice Company. The opinion was delivered by Commissioner Shaw and concurred in by the other members of the commission. It finds the value of the property of the company for rate-making purposes as of June 30, 1913, to be $65,000. The commission also found the rates charged by the company for electrical energy within the city of Kirksville to be unjust, unreasonable and excessive, the schedule being found to be discriminatory and unduly preferential. The maximum schedule of rates prescribed by the commission, in substance, follows: General lighting and power, 10 cents per kw-hr. for first thirty hours, 7 cents for next thirty hours and 4 cents for the remainder. Minimum charges: Residence lighting, 75 cents per month; commercial lighting, 5 cents per month for 60-watt equivalent of connected load with no less charge than $1; power, $1 per kw monthly minimum. This schedule is to continue in force for three years from July 1, 1914, and is a reduction of approximately 18 per cent from the rates charged in 1913.

Ohio Commission

Mr. E. W. Breyer has been employed by the Ohio Public Utilities Commission to prepare a system of depreciation charges applying to public utility companies.

Mr. Breyer does not employ the word "depreciation" in his system, but rather contemplates the creation of reserves by contemporaneous charges to operating expense accounts to provide for defraying the cost of "extraordinary maintenance, deferred upkeep and contingencies."

By the term "extraordinary maintenance" Mr. Breyer contemplates large repairs, but something less than the replacement of an entire unit. This would come about through deterioration of buildings or equipment for a long period of time. "Deferred upkeep" would mean the necessary replacement of complete units, retired by inadequacy, advance in the art or because of obsolescence. "Contingencies" would cover losses by fire, flood, earthquake, storm, etc.

Corporations must be given the trusteeship of the funds accumulated for these purposes, as representing trust funds paid in advance by the public, according to the commission's idea, and it is not contemplated that these funds should remain idle. The funds may be used for working capital or for financing extensions and improvements temporarily. Interest must be paid and evidences of indebtedness to the trust funds must be given.

Wisconsin Commission

The Wisconsin commission has authorized the Wisconsin-Minnesota Light & Power Company to issue $988,000 in common stock, $1,700,000 in 7 per cent cumulative preferred stock, and $3,750,000 in 5 per cent bonds. Stock to the amount of $650,000 and $1,288,000 bonds are to be exchanged for similar amounts of the company's securities now outstanding; common stock to the amount of $538,000 and $1,500,000 bonds are to be exchanged for the properties of the Chippewa Valley Railway, Light & Power Company and the Chippewa Valley Construction Company. The Wisconsin-Minnesota Light & Power Company, which was originally the La Crosse Gas & Electric Company, is now controlled by the American Public Utilities Company.

The commission has approved the application of the Richland Center Water, Light & Power Plant for a minimum bill for power service of 25 cents per hp per month and has approved the increase of 1 cent per kw-hr. for lighting service in so far as it applies to non-residents.

New Hampshire Commission

The Public Service Commission has issued an order approving the purchase by the Manchester Traction, Light & Power Company of a controlling interest in the Nashua Light, Heat & Power Company. The Manchester company will pay $224,280 for 5607 shares out of a total of 6000 outstanding shares in the Nashua company, and the rates will be reduced in Nashua to the Manchester schedule, the decrease below the present charges in Nashua being about 18 per cent. The transfer of control was to take place July 1, when an option on the Nashua property expired. The capital stock of the Manchester company will be increased 10 per cent to pay for the Nashua system, although the two companies will be operated separately, with a transmission tie line between their respective generating plants, which are about 25 miles apart. The line will be built in the near future, and the Manchester company will be able to utilize a portion of the output of the Nashua steam plant in case of a shortage of output in the hydroelectric stations of the Manchester company. Tucker, Anthony & Company, of Boston, are the banking interests in charge of the deal.

California Commission

The Southern California Edison Company has filed an application with the Railroad Commission of California for an order authorizing it to sell its electric distributing system at San Fernando, Los Angeles County, to the Pacific Light & Power Company.

Illinois Commission

An investigation has been ordered by the City Council of Lincoln, Ill., of the water and electric rates charged by the Lincoln Water & Light Company. The committee will make a valuation of the plant, study rates and report its findings preliminary to an appeal to the state commission.

The dispute between the city of Barry and the Central Illinois Public Service Company over the rate for electric energy and the service to be given has been settled before the Illinois Public Utilities Commission. When the company's franchise expired in Barry the city refused to renew it unless a reduction in rates and better service were stipulated. The company refused to meet the terms, and a party of local business men formed a company and applied to the utilities commission for a certificate of convenience and necessity, the understanding being that they would ask the commission, after getting the certificate, to compel the Public Service corporation to sell them energy at a price which would enable them to retail it at the lower figure mentioned by the City Council. There has been a private agreement, however, and the commission granted the certificate to the new company with the understanding that the franchise which that company will get will be transferred to the Public Service company, a consolidation thereby being effected. The new company amends its twenty-year franchise to give to its customers a maximum rate of 12 cents per kw-hr. for the first thirty hours' use per month of the active connected load (figured at 75 per cent) and 8 cents per kw-hr. for each additional hour's use per month, and a discount of 1 cent per kw-hr. for cash within ten days after the first of the month. The Public Service company will rehabilitate its plant and furnish twenty-four-hour service.

Current News Notes

ICE IS NOT A PUBLIC UTILITY.—The public welfare committee of Los Angeles, Cal., has reported to the City Council that in its opinion the Council cannot regulate the price of ice. The Council adopted the report. The question of regulation of the price to be charged for ice arose from alleged discrimination.

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GOOD THUNDER WANTS ELECTRICITY.—The village of Good Thunder, Minn., with a population of about 500, has petitioned the Mankato division of the Consumers' Power Company for electric service. The good people of Good Thunder agree to construct the necessary transmission line from Rapidan, where the hydroelectric generating station is situated. The proposed transmission line would be 6 miles long.

* * *

LINEMEN DEMAND THAT THEY SHALL WORK IN PAIRS ON HIGH-TENSION LINES.—In order to minimize the possibility of accidents while working on high-tension circuits the linemen employed by the Springfield (Ohio) Light, Heat & Power Company have demanded that two men be allowed to work together on all high-voltage lines. By so doing it is claimed that accidental contact with conductors carrying dangerous potentials can be avoided to a great extent.

* * *

HIGH HEAD DAM COMPLETED IN PORTO RICO.—The Porto Rico Railway, Light & Power Company, which supplies the city of San Juan with its electrical utilities, has recently completed the erection of a 126-ft. dam at its plant in the mountains of the interior, 18 miles from the coast. The dam is 476 ft. long, and the head provided thereby adds greatly to the possible output of the station. At present the energy demand for lamp service is over 80,000 16-cp equivalents.

* * *

MUNICIPAL OPERATION URGED IN MICHIGAN.—At the annual convention of the League of Michigan Municipalities held at Bay City, Mich., June 24, Mr. William H. Fitzhugh, superintendent of the Bay City municipal lighting plant, read a paper presenting arguments for municipally owned electric-lighting plants. Mr. Fitzhugh argued that one of the principal causes of corruption in municipal governments is the attempt of franchise owners to increase their privileges under franchises already held.

* * *

A BOX-KITE TELEPHONE LINE.—During a recent flood in the Salinas River in California a number of poles of a telephone-line crossing were washed out and until the waters receded box-kites were resorted to to support the temporary circuits across the swollen stream. A bridle wire was first sent across the river by means of a number of kites, and then this strand was used as a messenger for drawing the telephone wires across. The kite-supported line served for communication until a permanent cable could be laid across the stream.

* * *

MIDDLE WEST UTILITIES COMPANY PERFECTS SAFETY-FIRST ORGANIZATION.—To foster the development of safety-first principles employees of the subsidiaries of the Middle West Utilities Company have until recently been holding quarterly joint meetings under the direction of officers of the several companies. The results of these meetings were limited, however, as the men were loosely organized. A new system has therefore been established whereby the men in each division work through a committee and these committees in turn submit suggestions and recommendations to the officials through a general committee composed of heads of the smaller committees.

* * *

CONDITIONS FOR TESTING WIRELESS STATIONS.—The attention of owners and operators of radiotelegraph stations is called to the fact that considerable interference is being caused near the larger centers of population by stations conducting tests without due regard to the traffic being simultaneously carried on. Commissioner E. T. Chamberlain of the Bureau of Navigation, United States Department of Commerce, gives notice that stations desiring to conduct such tests should communicate with the local radio inspector by letter or telephone, stating the probable length of time that will be required. A station conducting tests or temporary experiments should "listen in" to determine that no interference is being caused, and during the test should "listen in" frequently for the interference signal, "Q R M." The station conducting tests must also transmit its official call signal frequently.

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SOCIETY MEETINGS

ANNUAL JOVIAN MEETING.—The next annual meeting of the Jovian Order will be held on Oct. 14, 15 and 16 in St. Louis, the home city of Jupiter W. N. Matthews.

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SASKATCHEWAN STEAM ENGINEERS.—The Saskatchewan Brotherhood of Steam and Operating Engineers will hold a convention and exhibit at Regina, Sask., Canada, July 28 to 30. Mr. H. J. Fox, Regina, is secretary.

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JOVIAN OUTING AT LOUISVILLE, KY.—The Jovian League of Louisville will hold an outing at Senning's Park July 14. Mr. Robert Montgomery and Capt. Walter Smith have charge of the arrangements. Mr. R. E. Brian is president of the league, and the board of directors comprises Captain Smith, chairman, and Messrs. John R. Chowning, Fred W. Gantt and James Clark, Jr.

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BROOKLYN COMPANIES' SECTION, N. E. L. A.—The sixth annual convention and banquet of the Brooklyn Company Section of the National Electric Light Association was held at the Oriental Hotel, Manhattan Beach, New York, June 24. At the afternoon session abstracts of the Philadelphia convention papers were read and the following officers were elected; Chairman, Mr. C. H. Stevens; vice-chairman, Mr. E. G. Bogeart; secretary, Mr. F. J. Farley; financial secretary, Mr. E. K. Ponzert, and treasurer, Mr. F. C. Hill. After the banquet addresses were made by Messrs. H. H. Scott and W. F. Wells.

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CEDARMEN ON CAMPING PARTY.—Members of the Northern White Cedar Association left Minneapolis, Minn., June 16, for an outing on the shore of Big Smith Lake, 8 miles from Marcell, Minn. There for three days the party enjoyed the liveliest kind of frontier life and incidentally held a business meeting to discuss the current affairs of the association and to receive the reports of various committees. Those in the party were President J. W. Benham, Chicago; Vice-president L. A. Page, Jr., Minneapolis; Directors M. J. Bell and L. A. Furlong, Minneapolis; Secretary N. E. Boucher; Messrs. J. Willemeyer, H. F. Partridge, W. C. Moss, T. M. Partridge, H. S. Gilkey, P. H. Anderes and W. A. Kerr, Minneapolis; M. H. Bissell and H. W. Reade, Escanaba, Mich.; M. Sperry, Milwaukee, Wis.; J. T. Kinney, Chicago; M. Chapman, V. Anderson, T. P. Bradley and Archibald McIntyre, Duluth, and Joseph Nagle, Bemidji, Minn.

A. I. E. E. Convention at Detroit, Mich.

Report of closing sessions of summer meeting with attendance of 459—Abstracts of papers and discussions presented at the six sessions—Recreation features of convention

FINAL registration at the thirty-first annual convention of the American Institute of Electrical Engineers, held in Detroit on June 22-26, was 459. This is considerably larger than the attendance at Cooperstown last year. Fifteen papers were presented at six sessions. There was considerable discussion, which is reported more fully below. Ample time was given for recreation, and the hospitality of the Detroit electrical men was greatly enjoyed. A brief report of the first three sessions was given in these columns last week.

High-Tension Transmission Systems

At the morning session of Thursday, June 25, President C. O. Mailloux, of New York, called to the chair Mr. Percy H. Thomas, of New York, chairman of the engineering data committee. Mr. Thomas presented his elaborate report on "Engineering Data Relating to High-Tension Transmission Systems." The report makes seventy printed pages, with several elaborate inset tables. The facts collected are presented without theorizing. About sixty drawings are reproduced, while others may be inspected in the office of the Institute in New York. There was considerable discussion on points brought out in this report, much of it relating to the deterioration of conductors of overhead transmission lines and the protection of telephone lines.

A specification covering the inspection and tests of high-tension line insulators of porcelain for over 25,000 volts was also presented by Mr. Thomas, as chairman of the high-tension transmission committee of last year and the engineering data sub-committee of this year. In the discussion Mr. E. E. F. Creighton, of Schenectady, N. Y., recommended strongly the use of oscillation transformers in the testing of insulators. Mr. Creighton described a method by which both very high voltages and very high frequencies may be obtained. The apparatus is portable and can be used for testing insulators on the line unless the pins are grounded. Mr. Creighton thinks this test better understood and less dangerous than the impulse test recommended in the appendix of the committee's specification. Mr. Thomas, however, thought that the test described by Mr. Creighton was not ready for formal recommendation in the specifications. As an operating engineer Mr. Farley Osgood, of Newark, N. J., strongly recommended the use of high-frequency tests for insulators.

Prime Movers and Cables

Past-president H. G. Stott, of New York, as chairman of the prime movers committee, presided over part of the session of Thursday afternoon. In introducing him, President Mailloux referred to Mr. Stott as the father of central-station economics. The president also pointed out that Mr. Stott's prominence in the study of this subject has led to his recognition as an authority by the International Electrotechnical Commission. Mr. Stott abstracted the paper on "Present Status of Prime Movers," by Messrs. W. S. Gorsuch, R. J. S. Pigott and himself. As a steel-mill electrical engineer Mr. R. Tschentscher, of Chicago, defended the blast-furnace gas engine, although later Mr. Stott explained that most of his gas-engine figures did not refer to the blast-furnace type. Mr. D. B. Rushmore, of Schenectady, N. Y., objected to the paper as having nothing to do with electricity. President Mailloux said that papers of this kind are of the greatest importance. Electrical engineers have taught power-plant men how to buy fuel and how to burn it scientifically. "We are entitled to the field of central-station economics," said Dr. Mailloux, "by right of discovery."

Messrs W. I. Middleton and Chester L. Dawes, of Cambridge, Mass., presented a paper on "Voltage Testing of Cables." Mr. Middleton abstracted the paper and there was discussion by Messrs. W. A. Del Mar (written), H. G. Stott, C. O. Mailloux and others.

Presentation of Edison Medal to Dr. Charles F. Brush

A pleasant feature of the convention was the presentation of the Edison medal to Dr. Charles F. Brush, of Cleveland, on the evening of June 25. President Mailloux made the presentation speech. He said that Mr. Brush laid the foundation for an entire industry, that of electric lighting. Brush's invention of the series arc lamp, his improvement of the Gramme dynamo-electric machine and his automatic cutout for arc lamps constituted an entire system. By 1880 a new art and industry had been created. In 1882 the first incandescent electric-lighting central station was put into operation. Dr. Mailloux referred to the conflict which ensued between the arc and incandescent lighting systems. He said that he was in a position to know because about that time he was editor of the *Electrical World*.

It is remarkable, commented Dr. Mailloux, how the names of Edison and Brush are now coupled after thirty years. Time has worn away all of the contentions of that earlier period. The speaker also said that Dr. Brush really invented the compound-wound dynamo in connection with the electrodeposition of metals. The work of Brush in connection with the storage battery was also outlined. In 1882 and 1883 the Brush Electric Company paid much attention to its storage-battery system. It demonstrated that storage batteries could be charged from an arc circuit, also that incandescent lamps could be operated on arc circuits. As an interesting historical incident, Dr. Mailloux mentioned the fact that in 1883 he published an interview with Edison, who then referred to the storage battery as one of those things that serve as an excuse for lying. To-day Brush has been out of the storage-battery business for twenty-five years, while Edison is himself conspicuously in the storage-battery business.

As president of the Institute, Dr. Mailloux then handed the Edison gold medal, incased in a leather receptacle, to Dr. Brush, saying that the medal was conferred in recognition of the epoch-making series of inventions which led to the creation of the pioneer electric-lighting industry. Dr. Brush responded briefly, expressing his appreciation of the honor. As the two men stood together, it was noticed that both wore the red ribbon of the Legion of Honor.

The Incoming President Introduced

President Mailloux handed past-presidents' badges to Secretary F. L. Hutchinson, with the request that they be presented later to Past-presidents Gano Dunn and Ralph D. Mershon.

Mr. Farley Osgood, of the board of directors, presented to Dr. Mailloux his president's badge. In doing so he gave a gracefully worded recital of the services and honors of the present president of the Institute.

Mr. Paul M. Lincoln, of Pittsburgh, president-elect of the American Institute of Electrical Engineers, was next introduced by Dr. Mailloux and spoke briefly. He made an earnest plea for the co-operation of the members. Later the ladies and gentlemen adjourned to the basement restaurant in the hotel, where many of the prizes for athletic and other contests were awarded.

Sterilization of Water

On Friday afternoon Dr. M. von Recklinghausen presented a paper entitled "Sterilization of Water by Ultra-Violet Rays of the Mercury-Vapor Quartz Lamp." Dr. von Recklinghausen, recently of Paris, but now of New York, expounded the subject of his paper, with the aid of charts and lantern-slide pictures. An interesting contribution to the discussion of this paper was made by Mr. Theodore A. Leisen, general superintendent of the Detroit Water Works. The author of the paper made the statement that with electricity at 1 cent per kw-hr. it would cost about 60 cents per 1,000,000 gal. to sterilize drinking water by use of the ultra-violet rays in the manner described.

Telegraphy and Telephony

Mr. Frank F. Fowle, of Chicago, chairman of the telegraphy and telephony committee, presided while one paper was presented. It was that by Mr. Carl Kinsley, of the University of Chicago, and gave the first public description of a system of high-speed printing telegraphy devised by the author. Mr. Kinsley demonstrated the receiving end of the apparatus, which uses a perforated tape. Mr. C. R. Underhill, of New Haven; Mr. Ralph W. Pope, honorary secretary of the Institute, and Prof. G. S. Macomber, of Cornell University, participated in the discussion.

President-elect Lincoln presided while Mr. Frank F. Fowle presented, in abstract, his paper on "Toll Telephone Traffic—An Experimental Study of the Relationship Between Circuit Loads and Delay to Traffic." The author said that the paper was a consideration of the fundamental problem, from the commercial point of view, of the handling of toll traffic. Mr. J. L. Wayne, of Indianapolis, discussed the paper, and then Mr. Lincoln declared the technical sessions adjourned.

Section Delegates in Conference

Every day during the convention the delegates from sections met together at luncheon and discussed in an informal way matters of common interest. On the afternoon of Friday, the closing day of the convention, there was a general experience meeting, open to all members of the Institute, at which reports were received from various sections. Mr. P. Lincoln presided at this conference. It is interesting to note that the Institute has thirty sections and that twenty-six of this number were represented officially by delegates present at some time during the convention. Not all, however, were able to stay until the concluding meeting.

Short reports were received from section chairmen and others as follows: Atlanta, Mr. A. M. Schoen; Boston, Mr. G. W. Palmer, Jr.; Chicago, Mr. W. B. Jackson; Cleveland, Mr. E. H. Martindale; Detroit-Ann Arbor, Mr. H. H. Norton and Mr. E. L. Bailey; Indianapolis-Lafayette, Mr. R. Fleming; Ithaca, Mr. W. G. Catlin; Los Angeles, Mr. E. R. Northmore; Lynn, Mr. E. R. Berry; Madison, Mr. C. M. Jansky; Minnesota, Mr. W. T. Ryan; Panama, Mr. F. C. Clark; Philadelphia, Mr. H. A. Hornor; Pittsburgh, Mr. A. M. Dudley; Pittsfield, Mr. W. W. Lewis; Portland, Ore., Mr. G. P. Nock; St. Louis, Mr. F. J. Bullivant; Seattle, Mr. S. C. Lindsay; Spokane, Mr. J. B. Fisken; Toronto, Mr. D. H. McDougall; Urbana, Mr. Morgan Brooks; Vancouver, Mr. E. M. Breed.

Some Other Features

During the convention a very enjoyable outing was held on the afternoon of June 24. It took the form of a steamboat excursion to Bois Blanc Island. At this beautiful park there was a baseball game which resulted in the defeat of Captain Hall's Tigers by Captain Osgood's Giants, the score being 17 to 6. There was a pleasant evening ride back to Detroit and the party returned to the hotel about 11 p. m.

Resolutions of thanks were adopted, expressing the appreciation of the Institute for the hospitality of local members, the Detroit Edison Company, electrical manufacturing companies, automobile manufacturing companies, the Detroit Golf Club, the Detroit Tennis Club and others. Mr. Farley Osgood, of Newark, N. J., was chairman of the convention committee, and Mr. C. C. Owens, of Detroit, was chairman of the general local committee.

An abstract of Mr. H. C. Ford's paper on the use of gyroscopes in marine work was presented in last week's issue in connection with our report of the first three sessions of the convention. In the following columns will be found a number of abstracts of remaining papers and the discussions which followed their presentation.

Electric Heating in Marine Service

While electric heating is relatively more expensive than steam heating, the actual cost of such heating is not so high aboard ships, where energy can be generated for about 1 cent per kw-hr. or even less in some cases. Messrs. C. S. McDowell and D. M. Mahood pointed out in their paper on "Electric Heating as Applied to Marine Service" that electric heating aboard ships is particularly desirable because of the convenience in locating the heater where it is most effective, the simplicity and low first cost of such installations, better heat regulation, and the absence of leaks, noises and disagreeable odors. In addition, an electric heater saves space and minimizes weight.

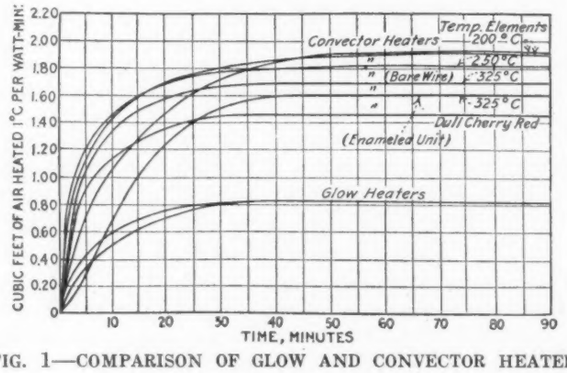


FIG. 1—COMPARISON OF GLOW AND CONVECTOR HEATERS

Radiant heaters are adapted to conditions where a small amount of warmth is needed intermittently. The glow-lamp type is used most extensively, although the resistance-wire type operated at red heat is coming into use. Convector heaters are better adapted to continuous heating. Attention was called to the fact that it is more economical to heat a large volume of air

through a few degrees than to heat a small quantity to a higher temperature. Practice has settled upon a long low heater equipped with a deflector which distributes the heated air uniformly about the room. Curves were shown indicating the rate of temperature rise for different heaters, and temperature distribution in different-sized rooms using various deflectors.

Results of tests led to the following conclusions: For each 1000 cu. ft. of space 1500 watts input is required to maintain a temperature of 70 deg. Fahr. in a stateroom provided the heater is placed in the center of the space and the entire air content has to be replaced by air at 32 deg. Fahr. every fifteen minutes. When heaters are placed close to metal bulkheads 1300 watts are required per 1000 cu. ft. of space. Deflectors reduce the energy requirements in the above-mentioned cases to 1200 watts and 1100 watts respectively. Where the space heated exceeds 20 ft. in length or width more than one heater is needed. When heaters are installed near a bulkhead or metal work they should be separated therefrom by heat insulation. It was also pointed out that it has seldom been found necessary to increase the generating equipment of ships for electric heating as the heating load fits in with the other demands to make a diversified load.

Discussion

Mr. W. S. Hadaway, Jr., of New York, contributed a written discussion which was read by Mr. W. C. Smith, of Pittsfield, Mass. Mr. Hadaway declared that the author's conclusion in favor of the convection method of heating was a little premature. Mr. Alfred E. Waller, of Bronxville, N. Y., thought that the inclosed-coil heater was as effective as the open-coil type. For marine use he recommended the inclosed heaters so that the moisture encountered would not come into contact with the resistance. Mr. D. B. Rushmore, of Schenectady, noted the fact that the cost of 1 cent per kw-hr. given in the paper was apparently arrived at without taking into consideration investment or interest charges. On land distributing cost would also have to be taken into consideration. Prof. F. C. Caldwell, of Ohio State University, pointed out that with the radiant heater the heat is directed only on the body to be heated and that therefore the cost is not so great as might be imagined. Mr. C. D. Knight, of Schenectady, also took part in the discussion.

Direct-Current Motors

Mr. R. H. McLain presented a paper on "Direct-Current Motors for Coal and Ore Bridges" in which he pointed out that because of its greater torque a series-wound motor is best adapted to this class of work. Curves were shown and discussed regarding the necessary gearing for certain lengths of runs with given accelerations and decelerations. A problem was also worked out in full showing the method for determining the necessary resistance to put in series with the armature. On hoist service there is a choice of series, compound or shunt-wound motors. The conditions affecting the choice are amount of power available, voltage variation, height of hoist, and time required for the trip. In the opinion of the author, a series-wound motor should be used for speeds of 360 ft. per minute or less, if the height of hoist is such that at the speed used more than eight seconds is consumed in the trip. For greater speeds and shorter time periods a compound-wound motor should be used. For still greater speeds, 700 ft. per minute or more, a shunt-wound motor should be employed.

Discussion

The discussion was brief. Mr. D. B. Rushmore, of Schenectady, N. Y., remarked that in the industrial applications of electric motors one of the largest fields remaining for exploitation is the conveying of materials and goods in packages. The conveying of bulk material electrically has been pretty well covered. Mr. T. E. Tynes, of Buffalo, told of the use of electric hoisting motors, hoisting in multiple and lowering dynamically with one motor. In closing, the author said that dynamic braking was advantageous in the case of large hoisting motors because friction brakes are too large and expensive to maintain.

Keeping Down Peaks

Mr. T. E. Tynes in a paper entitled "Methods of Keeping Down Peaks on Power Purchased on a Peak Basis" mentioned two general ways of reducing peaks. The first method is to furnish the peak power from some separate source, such as a local steam-turbine plant. The second method is for the purchaser to store up energy previously and to use it during peak conditions. The author then described a method by which a mixed-pressure turbine was installed to take peaks. The turbine would not, unassisted, take all the peak that it was desired it should, and therefore a motor rheostat was furnished. On installing a maximum-demand meter which integrated the one-minute peaks the rheostat method of control was too slow. Another scheme of control was devised whereby a rod carrying three points which successively make contact with mercury cups was used. On making contact, a section of the resistance in the shunt-field rheostat of the turbine is short-circuited, thereby raising its voltage and causing it to take more load. At the same time a section of resistance is cut into the shunt-field rheostat of the motor-generator set, weakening its field and reducing its load. The third point makes contact if the other two do not raise the load on the turbine sufficiently.

Discussion

In opening the discussion Mr. R. Tschentscher, of Chicago, pointed out that reduction of the peak is of benefit to the seller as well as to the buyer where energy is purchased for the operation of industrial establishments. Mr. Paul M. Lincoln, of Pittsburgh, remarked that the maximum-demand method of buying and selling electrical energy is the only reasonable and scientific method. Mr. J. L. Woodbridge, of Philadelphia, said that it would be interesting to have the financial as well as the technical results of the Tynes method. Mr. J. R. Bibbins, Chicago, looked at the subject from the point of view of the central station. He spoke of a large contract for supplying energy to a street-railway system where the maximum period was one hour. The question is, Is the one-hour maximum justifiable where the real maximum for which the station must be prepared is less than one hour? Should a shorter period be prescribed? Mr. R. H. McLain, of Schenectady, contended that central-station companies should not force individual customers to go to great expense to cut down the peaks of their loads; rather they should seek other customers, with varying demands, so that the diversity factor will remedy the matter largely. A written discussion by Mr. E. D. Dreyfus, of Pittsburgh, summarized by Mr. K. A. Pauly, of Schenectady, made the point that Mr. Tynes' method was a specific application rather than a general remedy.

Concatenated Induction Motors for Mills

The paper presented by Mr. William Oschmann, entitled "Concatenated Induction Motors for Rolling-Mill Drive," described a six-speed concatenated induction-motor set for driving finishing rolls of a twelve-stand continuous mill. A set of nineteen curves showed the results of tests made on the whole steam plant. As a result, it was found that a large amount of exhaust

steam would be lost in case the low-pressure turbine were used for driving the finishing rolls directly. Moreover, more steam would be wasted if the turbine speed were varied with the mill speed. Operation and investment costs for the turbine equipment were also too high. It was therefore decided to install motor drive. The direct-current motor, while practicable, presented no advantages over the concatenated motor. An induction motor operating with a speed-regulating set had the disadvantage of requiring a commutator motor or synchronous converter. A concatenated induction motor was installed having a double-wound main motor and single-wound secondary motor, the primary motor to have fourteen and seventeen poles and a wound rotor. The secondary motor is to be arranged for four-pole and eight-pole connection, and its rotor will be of the squirrel-cage type. Both stators were mounted on a common bed-plate, and the rotors on a common shaft. The control system was described in detail. It is simple, and no regular attendant is needed. The motor has six definite speeds and two additional resistance speeds. As a result of the year's operation there have been but three interruptions, and the total loss of time due to these has been sixty-eight minutes.

Discussion

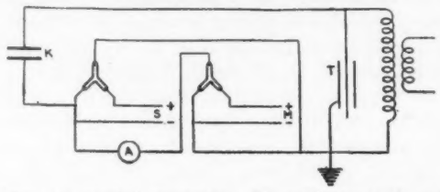
As a steel-mill man, Mr. R. Tschentscher, of Chicago, commented favorably on the equipment described in this paper, noting its reliability, low operating cost and ability to control machine movements rapidly. Mr. A. E. Averrett, of Schenectady, declared that where there is a big range of speed, the power-factor of the concatenated motor will be very low. With limited range of speed it is possible to install an equipment of concatenated motors reasonable in cost.

High-Voltage Measurement with Sphere Gap

In his paper entitled "The Sphere Gap as a Means of Measuring High Voltage" Mr. F. W. Peek, Jr., declared that a gap method of measuring high voltage is desirable in certain tests since the gap measures the maximum point of the voltage wave. At high voltages the needle gap is unreliable, inconvenient and seriously affected by humidity. The sphere gap is free from complicated corrections and the curve is subject to calculation. The correction for air density—that is, altitude and temperature—which has to be made whereever voltage is measured by a gap has been made for the sphere gap over an air-density range equivalent to that from sea level to 18,000 ft. elevation. A spacing three times the radius may be used without appreciable corona. An equation is given for calculating the sphere spark-over curves for various spacings, radii, air density, etc. The apparent surface gradient at spark-over, in the non-grounded case, increases with decreasing radius of sphere. Tables are given showing the spark-over voltages for different-sized spheres and different spacings, at sea level and a temperature of 25 deg. C. These give a standard curve which may be made to apply to any given altitude by means of a correction factor. Curves are given showing how well the measured values check with the calculated values. Curves should be calculated, it is emphasized, only when standard measured curves cannot be obtained. Over commercial range there is no variation due to frequency. The author believes that local over-voltage and not high frequency causes destruction of insulation. A non-inductive resistance should be placed in series with the gap to prevent oscillations and to limit the current discharge.

The Electric Strength of Air

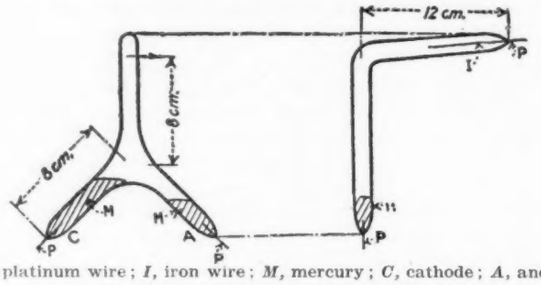
Dr. J. B. Whitehead and Mr. W. S. Gorton, professors of electrical engineering at Johns Hopkins University, in the fifth of a series of articles entitled "The Electric Strength of Air," presented the account of an investigation of the influence of frequency on the corona between sixty cycles and 3000 cycles per second. The wire and coaxial cylinder method was used. A sensitive



A, voltmeter; *S*, special generator; *K*, condenser; *M*, city mains; *T*, corona tube.

FIG. 2—DIAGRAM OF CONNECTIONS FOR MEASUREMENT OF MAXIMUM VOLTAGE

gold-leaf electroscope was used to detect the first appearance of corona. The maximum value of the alternating voltage wave was found by the method of Chubb and Fortescue, substituting the mercury-arc rectifier for the mechanical device used to have one-half the current wave pass through the measuring instrument. The current taken by the condenser could not be used to maintain the arc, consequently the cathode was kept active by an arc playing between the cathode and an auxiliary mercury anode (for arrangement and connections see diagrams). A Crémieu electrostatic-electrodynamic balance was used to measure the effective value of the voltage. The corona voltage at 2000 cycles is lower by 3 or 4 per cent than it is at sixty cycles. At about 425 cycles, and within a certain range of field excitation, there was a pronounced evidence of reso-



P, platinum wire; *I*, iron wire; *M*, mercury; *C*, cathode; *A*, anode.

FIG. 3—ARRANGEMENT OF AUXILIARY ARC

nance in the high-tension circuit. The corona in the range 300 cycles to 3000 cycles has a number of qualitative differences compared with that at sixty cycles. The rate of discharge of the electroscope was found to be directly dependent on the frequency and at high frequencies the presence of the corona caused the wire to vibrate greatly.

Sphere-Gap Discharge Voltages

Mr. J. Cameron Clark, assistant professor of electrical engineering, and Mr. Harris J. Ryan, professor of electrical engineering, at Leland Stanford, Jr., University, presented a paper on "Sphere-Gap Discharge Voltages at High Frequencies," in which they described a series of experiments made by them to determine the values of steady, high-frequency, high voltages required to discharge between 7-in. copper spheres, in air, at ordinary temperatures and barometric pressures. A 15-kw Poulsen-Federal arc generator was used as a source of high-frequency sustained high voltage. The apparatus used in securing and measuring currents from 85,000 cycles to 612,500 cycles is described in detail. The sphere-gap standard consisted of electrolytic copper spheres mounted on the ends of brass tubes in treated wood frames. Gap lengths were determined by means of calipers and micrometer screw or steel scales.

The 123,000-cycle values locate a right-line relation for sphere gaps and discharge voltages, which when produced passes through the origin. The authors give the mathematical relation existing between the root-mean-square kilovolts and the gap length for frequencies between 123,000 cycles and 255,000 cycles.

Discussion

The three scientific papers by Messrs. Peek, Whitehead and Gorton, and Clark and Ryan were discussed together. Dr. Whitehead, who presided at the session as chairman of the electrophysics committee, remarked in opening that the whole subject of the investigation of the corona as affected by frequency is in a chaotic condition. A written discussion by Mr. L. W. Chubb, of Pittsburgh, was read by Mr. Paul M. Lincoln. The writer said that the theories of corona formation so far advanced can hardly be adopted as laws. Below 300,000 volts the sphere-gap seems to furnish a reliable method of measuring high voltages. Above that it is rather unreliable. Mr. Chubb described the breakdown tests in the laboratory of his company at Pittsburgh.

Prof. F. C. Caldwell, of Ohio State University, alluded to the trouble experienced from oscillations in testing transformers. A communication from Mr. D. M. Mahood, of New York, was read by Mr. A. E. Waller, of Bronxville, N. Y. This contribution related to the Clark and Ryan paper, and Mr. Mahood said that the results outlined should be checked further for stability. Mr. C. L. Fortescue, of Pittsburgh, said that some of the assumptions in Mr. Peek's paper were unwarranted. He spoke of the experiences of Mr. Chubb and himself with spark-gaps representing voltages of 600,000 and more. He said that there was a large discrepancy between theoretical figures and the actual figures obtained by test at Pittsburgh. As to the Whitehead and Gorton paper, Mr. Fortescue declared that the use of the mercury rectifier introduced possibilities of error. The speaker also gave an account of the work in Pittsburgh relating to resonance in transformers. In relation to the Clark and Ryan paper Mr. Fortescue was inclined to think that the tests cannot be considered as final.

Prof. D. D. Ewing, of Purdue University, called attention to the fact that the commercial direct-current permanent magnet instrument must be used with caution. Mr. E. E. F. Creighton, of Schenectady, N. Y., commented on the lack of some instrument that will actually measure voltage at high frequency. Mr. Creighton recommended the use of high frequency for testing insulators and alluded to a new vacuum lightning arrester. Mr. H. B. Dwight, of Hamilton, Ont., said that the use of choke coils with iron cores should be avoided. With diagrams he described a method of testing 100,000-volt insulators.

Mr. W. W. Lewis, of Pittsfield, Mass., said that some carbon rods have been found to be reliable. He alluded to rods having about 400 ohms resistance. Reference was made to tests designed to show the effect of the presence of objects of wood, metal and porcelain in sphere-gap arc-overs. Other contributors to the discussion were Messrs. E. P. Peck, of Atlanta; J. R. Craighead, Schenectady, and Dr. M. G. Lloyd, Chicago.

In closing, Mr. Peek said that it is unwise to deprecate theory in the making of an investigation such as that under consideration. The discrepancies between the speaker's results and those obtained by Mr. Chubb were doubtless caused by oscillations. Dr. Whitehead said that the papers gave some evidence of the lowering of the corona voltage with the rise of frequency, but this lowering is surprisingly slight. As to Mr. Fortescue's statement that the mercury rectifier may have caused error in the Whitehead-Gorton investigation, the explanation was interesting but doubtful.

Report on High-Tension Transmission

The sub-committee presented its report, prepared by Chairman P. H. Thomas, giving "engineering data relative to high-tension transmission systems." This report gives an analysis of the engineering data received from twenty-five power transmission companies operating high-tension systems, in answer to a printed list of questions. A considerable part of the data has been consolidated in tables. Other data are presented under the various topics to which they relate, and in a third section notes have been added. The reporting companies have been listed with a brief statement as to the character of each plant. In addition many companies furnished blueprints, drawings, maps, etc. Many of these are reproduced in the form of illustrations at the end of the report.

Discussion

Mr. J. B. Fisken, of Spokane, brought up the subject of deterioration of metallic conductors used in overhead transmission lines. He exhibited a sample of a solid copper conductor that was pitted to the extent of perhaps 1/16 in. This was part of a transmission line installed at an elevation of 2500 ft. where the average precipitation is 22 in. The cause of the pitting is unknown. Mr. E. V. Pannell, of Toronto, said that 40 per cent of the companies mentioned in the committee's report are using aluminum transmission wires to a greater or less extent. Aluminum is now also used on very long spans. Mr. Fisken said that no deterioration has been noticed in his company's aluminum wires after five years of operation. Mr. Thomas mentioned the possibility of using steel-aluminum transmission cables. Mr. E. E. F. Creighton, of Schenectady, said that perhaps the corona discharge caused nitrous oxide to form and corrode the copper in Mr. Fisken's sample. Mr. F. W. Peek, Jr., of Schenectady, thought this explanation of brush discharge to be the correct one. At each tie wire apparently a miniature nitrous-oxide generator is established. Mr. Peek explained the chemistry of this theory. Apparently aluminum is not affected in the same way. Mr. Peek said that the cause of the trouble is the combination of two dielectrics of different specific capacity in series. It can be corrected by coating the top of the insulator with conducting material and connecting that coating to the conductor. Mr. Thomas remarked that it is not the potential but the fall of potential across the air-gap which produces ozonizing or nitrous-oxide formation. Mr. R. Fleming, of Indianapolis, said that he was not entirely satisfied with the nitrous-oxide explanation. Dr. M. von Recklinghausen, of New York, gave his opinion as a chemist that the trouble might be due to electrolysis between the tie wire and the conductor. Prof. D. D. Ewing, of Purdue University, thought the trouble might be due to organic salts in dust from the soil.

Mr. E. F. Peck, of Atlanta, described a method of protecting a telephone circuit operated on the poles of a 110,000-volt transmission line. The normal operating potential of this telephone line is 5000 volts to ground. Trouble had been experienced with the insulators breaking down, and Mr. Peck described the careful method worked out to protect the telephone line, including the use of the new vacuum arrester, a condenser and a drainage coil. Mr. Thomas explained the principle of the drainage or leakage coil. It is important to have enough capacity in the drainage coils and to have a number of them on long lines. These coils will enable speech to be maintained. To protect the operator, lightning arresters, air-gaps and one-to-one transformers are necessary if the telephone circuit is on the same overhead construction as the transmission lines.

Mr. Creighton, of Schenectady, spoke of the new

vacuum lightning arrester. Designed specifically for the signal circuits of steam railroads, it can never be short-circuited and so give false signals. It will stand 1000 amp of direct current at 600 volts and open the circuit-breaker without short-circuiting. Its limitation is that it cannot carry current for a long time. Mr. R. E. Argersinger, of Schenectady, said that where two parallel transmission lines are installed reverse-energy relays should be used for protection. Messrs. S. C. Lindsay, of Seattle; E. A. Lof, of Schenectady, and others took part in the discussion.

Specifications for Insulator Tests

In the report on specifications covering inspection and tests of high-tension line insulators of porcelain for 25,000 volts and above, methods were described which have been found useful under ordinary conditions of energy-transmission work. The report is expected to serve as a skeleton and to be supplemented where conditions warrant it. Certain portions were added as a guide where several bidders are competing. In the specification attention is paid to the following, for inspection: form, drawing, inspection, design; corrosion and factor of safety of metal parts; quality, glazing and absorption of porcelain, and assembling. For testing, attention is directed to wave-form, control and measurement of voltage, conditions of test, frequency, breakdown and flash-over definitions, rain and oil tests, mechanical and electrical design tests, and electrical routine tests before and after assembling.

Discussion

Mr. E. E. F. Creighton, of Schenectady, recommended strongly the use of the oscillation transformer in testing insulators. A convenient frequency is 200,000 cycles. Insulators of the older type are apt to be porous owing to under-firing. It is often desirable to test insulators in place, and the apparatus described can be used as a portable set for testing of this description. Mr. Creighton thinks that this test is better understood and less dangerous than the impulse test. Chairman Thomas, however, said that he thought the test described by Mr. Creighton not yet ready for specification. He commented on the rapidity with which the dielectric strength of porcelain goes down as the temperature goes up. Prof. Edward Bennett, of the University of Wisconsin, indorsed the Creighton test in preference to the impulse test. He remarked that both can be made identical as to heating by the use of a circuit-breaker in the primary circuit.

Mr. Farley Osgood, of Newark, N. J., as an operating engineer, made a vigorous plea for the use of high frequencies in testing high-voltage insulators. The new standard insulator for this purpose is smaller than the old one but has thicker petticoats. Each insulator should be, from an operating point of view, a spillover point, like an arrester.

Mr. J. B. Fisken, of Spokane, said that he had found out that there was no danger from a stream of water from a fire hose striking a 60,000-volt transmission line. Therefore, he believes that the rain test of insulators is entirely unnecessary.

Mr. F. W. Peek, Jr., of Schenectady, declared that the term "high frequency" is used without sufficient discrimination. Just what is meant should be defined.

Mr. W. B. Jackson, of Chicago, spoke of mechanical shock to insulators and the importance, if possible, of devising some test approximating in advance the effects of weather conditions.

Prime Movers

Messrs. H. G. Stott, R. J. S. Pigott and W. S. Gorsuch, of the committee on prime movers, presented a paper entitled "Present Status of Prime Movers," treating the topics of capacity, efficiency, economy, weight and cost of the reciprocating steam engine, steam turbine, gas engine, oil engine and hydraulic turbine both separately and comparatively. The steam turbine has now with a few minor exceptions successfully defeated the reciprocating engine in all instances. Curves were given for the steam turbine, showing the water rates, the Rankine-cycle efficiency, total weight and weight per kilowatt, total cost, cost per kilowatt and cost per pound for various sizes of machines. For the gas engine the following curves are shown for various sizes of machines, both for vertical and horizontal types: Average weight per kilowatt; total, average and minimum weights; total cost; cost per pound; cost per kilowatt, etc. In addition curves are shown for fuel consumption, lb.-Fahr. heat units per kilowatt-hour, and thermal efficiency in terms of per cent of normal full-load rating. The figure $95 per kilowatt installed, including engine and generator complete but without foundation, is given as the average of the most reliable figures available for the Diesel engine. Efficiency curves are shown for waterwheels and hydraulic turbines. Efficiencies of hydraulic turbines have recently been obtained reaching 90 per cent and higher. The cost of these turbines and generators larger than 200 kw will vary from $30 to $10 per kilowatt installed, exclusive of foundations. Comparative investment and fuel costs of a 750-kw and of a 20,000-kw steam turbine, gas engine and oil engine, including a directly connected sixty-cycle generator operating at different percentages of normal full load, were shown. These curves reveal that the ratio of steam to gas and oil units is decidedly in favor of the former. In low-priced fuel districts the hydraulic turbine is only a competitor of the steam turbine where the development costs are moderate and the load-factor reasonably high. Other curves show the thermal efficiency and rates of heat consumption per kilowatt for the different types of prime movers. The authors not only declare that the steam turbine is more economical than any other type of heat engine but add that it has surpassed even the gas engine in thermal efficiency.

Discussion

Mr. R. Tschentscher, of Chicago, took up the cudgels for the blast-furnace gas engine. In the last seven years the situation has been materially altered. Many troubles were encountered at first in the use of this type of gas engine, but it is now realized that this form of prime mover has a footing based on true economics. Of about 450,000 kw generating capacity in the steel-mill electric plants, about 175,000 kw is driven by blast-furnace gas engines. The United States Steel Corporation alone has about 140,000 kw in blast-furnace gas-engine-driven units. Plants range in size from 1000 kw to 64,000 kw. As to size of units, manufacturers will bid on machines up to 3000 kw. The weight per output is less for the larger sizes. Operating costs are less than 0.275 cent per kw-hr. As to cost of fuel for gas engines, the figure of $3 per ton mentioned in the paper is too high; $2 would be more nearly right. The investment cost of $65 per kw given for the gas engine is too high in the case of blast-furnace engines; $50 would be nearer right.

Mr. J. R. Bibbins, Chicago, as one rather favorably disposed toward the gas engine, also criticised mildly some features of the paper. Referring to the comparison of one 20,000-kw steam turbine with ten 2000-kw gas engines, Mr. Bibbins said that it was not fair to take the half load of one 20,000-kw unit and compare that with ten 2000-kw units at half load, whereas in the case of the gas engines five of them could be operated at full load to get the same output.

Voltage Testing of Cables

Messrs. W. I. Middleton and Chester L. Dawes, in a paper on "Voltage Testing of Cables," contended that the present practice of allowing a factor of safety of 2.5 was basically wrong. They would substitute the formula $S = \frac{0.868\,V}{d \log_{10} \frac{D}{d}}$, showing that the allowable stress, besides being proportional to the voltage, depends also upon the diameter (d) of the conductor and the diameter (D) of the insulation. This means that the minimum stress and maximum allowable voltage occur when the conductor has a diameter 10/27 of the diameter of insulation. If the insulation is overstressed there is an accompanying change of insulation resistance and capacity. In this country rubber compound, paper and cambric are generally used for cable insulation. In testing, the voltage may be applied, (1) by submersion, (2) between the conductor and metallic sheath and (3) between wires. The first is the most severe. A sine wave is desirable for testing purposes,

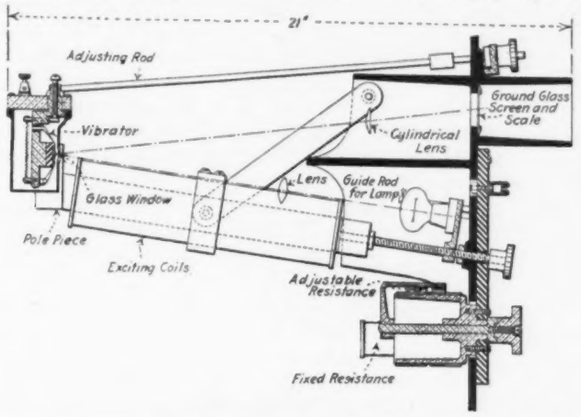


FIG. 4—SECTIONAL VIEW OF SIMPLEX VIBRATING VOLTMETER

but rarely occurs with a commercial generator under these severe conditions of load. However, a special 85-kva generator has been built which so far has given a sine wave. Reactance is not satisfactory in reducing the volt-ampere load on the generator. On measuring the voltage the alternating-current voltmeter was not successful. The needle spark-gap was tried but was too apt to cause serious disturbances and thus break down the insulation. The writers have devised an instrument, based on the principle of the oscillograph, with which the maximum voltage may be determined regardless of the wave form. A sectional view is shown.

Discussion

Mr. W. A. Del Mar, of New York, in a written discussion, commended the paper and believed it should have a good influence in improving conditions of cable testing. Dr. C. O. Mailloux, of New York, described an English method of making paper insulation, not generally known in this country. Mr. H. G. Stott, of New York, told of cables laid fifteen years without showing deterioration. These cables have been tested at two and one-half times rated voltage at least once a year. Some underground cables designed for 6600 volts are operated at 11,000 volts. Heavier insulation is required for large conductors as compared with small conductors for mechanical protection. Messrs. E. E. F. Creighton, of Schenectady; C. L. Fortescue, of Pittsburgh; Percy H. Thomas, of New York; J. R. Craighead, of Schenectady, and the authors of the paper took part in further discussion. Some attention was paid to the interesting fact that long cables will not stand as much voltage under test as short lengths of cable. Mr. Fortescue said that this might be accounted for by distributed capacity.

Sterilization of Water

Mr. M. von Recklinghausen, in a paper entitled "Sterilization of Water by Ultra-Violet Rays of the Mercury-Vapor Quartz Lamp," described the advantage of the ultra-violet ray in that capacity. The only industrially applied source of ultra-violet light is the mercury-vapor quartz lamp. With an increase in temperature of this lamp there is a considerably greater increase in the ultra-violet rays than in the violet rays. The true way of defining the ultra-violet radiation, by spectrum analysis, is inconvenient and scarcely practicable. The power of the ultra-violet spectrum may, however, be examined by analysis of the energy in the spectrum, by ultra-violet light falling on a condenser, thereby ionizing the air, by chemical reaction, and by bactericidal or abiotic action. In this last reaction the method employed is the measure of exposure necessary to kill paramicia. For most efficient results the mercury lamp should be submerged entirely in the water to be sterilized, at the same time protecting it from direct contact with the water. At the present time there is a large unit in Luneville, France, sterilizing the city water supply, and one in New York for the purification of the water in a swimming pool. The smallest lamp used operates at 110 volts, taking 2 amp; the largest at 500 volts, taking 2.5 amp. In such a case the energy consumption is between 50 kw-hr. and 130 kw-hr. per 1,000,000 gal. of water.

Discussion

After Prof. Morgan Brooks, of the University of Illinois, had made a remark on the physics of light sources, Mr. Theodore A. Leisen, general superintendent of the Detroit Water Works, remarked that the subject of water purification is one of real importance. He brought up the question whether increased turbidity of water would necessitate increased consumption of electrical energy in the ultra-violet process. Commercially this method will come into competition with the use of certain chemicals which have been successfully applied for water purification. However, the electrical method will be welcomed because there is objection to the introduction of any chemical into drinking-water supply. If hyperchloride of lime is introduced in too large quantities, some odor, and perhaps some taste, will result. Mr. Leisen believes that almost any city will be willing to spend a little more for the electrical method if it is equally effective.

Mr. W. B. Jackson, of Chicago, remarked that ozone is also used for water sterilization, and he asked as to the comparative costs of the two methods.

In closing, Dr. von Recklinghausen said that it would depend on the character of the suspended matter whether the sterilization would be handicapped. If the suspended particles are themselves polluted with microbes, it is probable that the process will not kill them. When very turbid, water should be filtered before being sterilized. Probably the use of hyperchloride of lime is cheaper than the electric ultra-violet light method, but more intelligent labor is needed with the chemical method. With electricity figured at 1 cent per kw-hr. it is believed that sterilization of water with ultra-violet rays will cost about 60 cents per 1,000,000 gal. However, the question should not be settled on the basis of dollars and cents, for the question of pure water supply is vastly important. In one

test abroad the cost of the ultra-violet method seemed to work out less than the ozone method.

Printing-Telegraph System

Prof. Carl Kinsley, of Chicago University, presented an article describing the high-speed printing telegraph system devised by him. The scheme used is simple and inexpensive and consists of a commercial typewriter to which is connected a punch which perforates a half-inch strip of paper with groups of holes distinctly placed in five rows, each group representing a letter. This paper then passes through the transmitter under a fine-wire brush which makes contact at the perforations. Batteries of either polarity are thus connected between the earth, and either one of a pair of conductors or batteries of different potential may be used. At the receiver end there are five elements, separately controlled, which make an autographic record by means of a local battery on a moving sensitized paper wherever they touch the surface. The author has been able to operate with a speed of 650 words per minute working duplex over an artificial line which was equivalent to 375 miles of an open-wire circuit having a conductor 0.43 cm in diameter.

Discussion

Mr. C. R. Underhill, of New Haven, who is himself an inventor in this field, said that this was one of the simplest forms of high-speed printing telegraph that had ever come to his notice. He wanted to know how the system would work in damp weather when there might be leakage on the line. Mr. Ralph W. Pope, of New York, expressed admiration for the novelty and ingenuity of the Kinsley system. Prof. George S. Macomber, of Cornell University, said that the Kinsley system seems to be a combination of the two general classes of high-speed printing telegraphs—the electromagnetic and the electrochemical types.

Toll Telephone Traffic

Mr. Frank F. Fowle gave the results of an experimental study of the relationship between circuit loads and delay to traffic in a paper on "Toll Telephone Traffic." The number of telephone messages per day which can be handled over a single toll circuit depends chiefly on the operating method employed and the number of circuits required to handle the total traffic between the given terminals. In Mr. Fowle's experiments the traffic was studied only on normal days; that is, Saturday and Sunday were excepted. Curves were given showing the relationship between circuit loads and average delay to traffic, typical load curves of toll traffic and the percentage of terminal traffic handled within a given interval or less. A study of curves shows that with a constant load-factor the effect of increasing the circuit loads will be to increase the average delay to traffic, and vice versa. There is a limit beyond which the delay in traffic will cause a loss of business due to dissatisfied subscribers. The revenue per circuit-mile per annum is directly proportional to the product of the circuit load of the toll rate per minute-mile. Consequently, the relationship between the quality of service of the toll-rate schedule is in general an obvious one, assuming that a certain fixed percentage of return on the plant investment is maintained.

Discussion

In the discussion Mr. J. L. Wayne, of Indianapolis, remarked that in telephone traffic the public should realize that speed costs money. He told of the practical difficulties of telephone operation, many of which are little realized by the general public in its eagerness for good service with low rates.

THE FORM OF ELECTRIC RATES

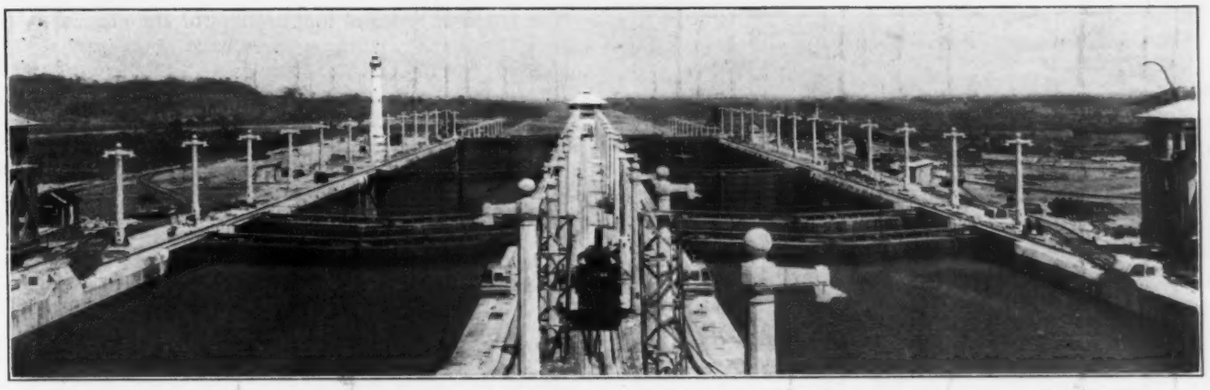
In an address presented before the Michigan Section of the National Electric Light Association on June 17 on "The Form of Electric Rates" Mr. William J. Norton, of Chicago, said that there are only three basic elements which should enter into the form of electric rates—quantity, demand and customer expense. The element of quantity is found in all rates, either in a simple form, as in the meter rate, or in an estimated quantity, as in the flat rate. The element of demand in electric rates is based upon the individual responsibility of the customer for the investment of the central station which stands ready to serve such customer. The customer expense is a minor element in rate-making and represents the cost to the company for such charges as meter reading, billing, postage, bookkeeping, etc., and bears no relation to either the quantity used or the demand of the customer upon the station.

Mr. Norton gives definitions and examples of different kinds of rates. The straight-line meter rate is the simplest of all. He advocates demand rates. A year or so ago he would certainly have said that the flat demand rate was antiquated and should not be used. But in the last year the development of this type of rate for small residence customers, especially as shown by Mr. S. E. Doane as the result of his interesting investigation in Europe, has brought this rate again to the front as a particularly desirable type. On the whole, for small users, the Wright demand rate is the most satisfactory to-day, said Mr. Norton.

The customers' output rate, Mr. Norton said, has been tried many times, but on the whole with very little success, and it generally results in letting the customer obtain service at an unduly low rate.

Of nine simple rate forms outlined Mr. Norton describes seven as distinctly good and two, one the step meter rate and the other the customers' output rate, as bad. He believes that any rate schedule should be based absolutely upon one of the seven good types, and after the cost curve for any particular class of business has been determined properly the company has its option of choosing one of the seven types. It is doubtful if the companies will ever have uniform rates, as rates are entirely functions of costs which vary in different localities, but it ought not to be difficult to have all of the rates established on one of the standard forms, and when so established better results are obtained by adhering closely to the standard form than by attempting to complicate a rate.

Mr. Norton considers it advisable in all cases that the cost curve be studied carefully and that afterward a proper selection of one of the seven types of good rates be made. The type of rate which most closely approximates the cost curve should be selected. Absolutely nothing is gained by innovation, and it may leave the rate schedule with inequalities which it will be extremely difficult to eradicate. Perhaps one of the best tests of a good rate schedule is to find out whether it can be changed. By change the speaker had generally in mind reduction. The business is developing so rapidly that reductions are possible very often, and if such reductions can be introduced into the schedule without disturbing it the schedule is apt to be a good one. This can be emphasized further in another way. In making the change in any rate schedule it should be made with a clear conception of not only the immediate change but what the subsequent changes may be. If the rates are on one of the simple standard forms, this can be accomplished generally with ease. If, on the other hand, the rates are complicated or contain steps that do not truly follow the cost curve, a change to a proper rate would become a difficult and serious matter.



Illumination and Electrical Features of the Panama Canal

THE lighting of the Panama Canal locks divides itself into three separate classifications—the exterior, the tunnel and the machine-room lighting. The locks are in duplicate, each lock having two boat chambers with a common center wall between and two side walls on the outside. At Gatun there is a triple lift with approach and wing walls at either extremity. The chambers are 110 ft. wide, the center wall is 60 ft. wide, and the side walls vary in width at the coping from a few feet to about 60 ft. It has been found desirable to throw the light from 300 ft. to 400 ft. back of the side walls. The total area illuminated at Gatun, therefore, is a strip a quarter of a mile wide and a mile long. At the Pedro Miguel and Miraflores locks the strips are somewhat reduced in length owing to the fact that single and double locks are constructed at these places.

Exterior Illumination

It was necessary to arrange the exterior illumination in such a manner that the pilots of ships approaching the locks should have a distinct view of all range and signal lamps. Light is obtained from 500-watt tungsten lamps set in concrete hoods 30 ft. above the coping. Single-bracket standards are used on the center wall and double-bracket standards on the outer walls. The standards on the center wall are arranged in two rows and are staggered. A single row of standards is installed on each outer wall. The lamps are spaced on centers from 50 ft. to 60 ft. apart and 21 ft. back from the chamber edge.

The proportions of the standards are massive, conforming to the heavy construction of the lock masonry. The standard is twelve-sided and is of simple design. It tapers from a section which is 1 ft. 10 in. between diametrical edges at the top to one at the base of the pedestal which is 3 ft. 6 in. between diametrical edges. The reflector is more ornate in design, but is essentially an arm of square cross-section supporting a concrete reflector at its extremity. The reflector is hood-shaped and is designed primarily to reflect the light properly. The bracket is surmounted by a concrete ball 1 ft. 11.5 in. in diameter. The over-all height of the complete standard is 34 ft. 4 in., while the over-all length of

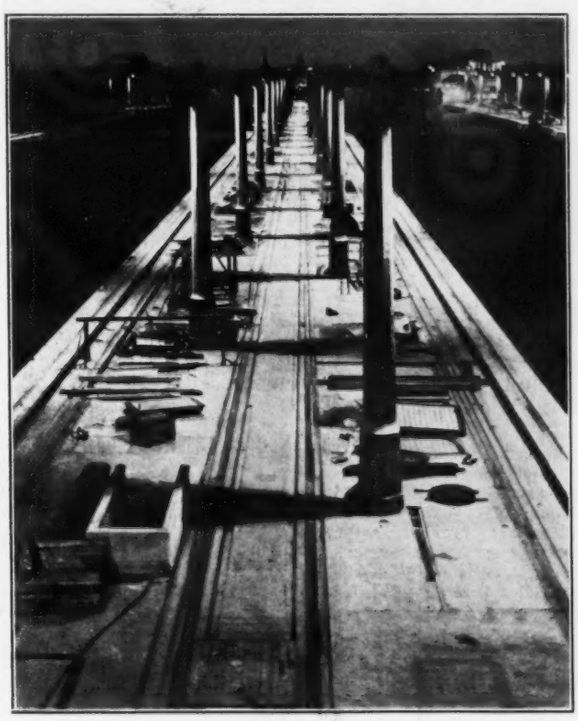


FIG. 1—NIGHT ILLUMINATION, GATUN LOCKS, LOOKING UP-STREAM ALONG CENTER WALL

FIG. 2—NIGHT ILLUMINATION, GATUN LOCKS, LOOKING DOWN-STREAM ALONG CENTER WALL

FIG. 3—GENERAL VIEW OF GATUN LOCKS LOOKING DOWN-STREAM FROM LOWER RANGE TOWER

the single-arm bracket is 7 ft. 1 in. and that of the double-arm bracket 12 ft.

The standard is designed to withstand a wind pressure of 25 lb. per square foot. The columns were reinforced with small angle irons on account of rough handling encountered in the casting yard. The pedestal was reinforced with deformed bars for anchorage purposes. The reflector bracket was reinforced with deformed bars used as a cantilever and also on account of rough handling in the casting yard. In the single-arm bracket the overturning moment is resisted by a U-strap bolted to the column reinforcement. This U-strap is unnecessary in the double-arm bracket, which is balanced. The reflector hood is reinforced by small rods formed on a template and electrically welded into a mesh which conforms to the outline of the hood. The

TABLE I—AMOUNT OF CONCRETE AND REINFORCEMENT IN STANDARD

Part	Concrete		Reinforcement, Lb.
	Lb.	Cu. Ft.	
Pedestal	5870	39.2	177
Column	5835	38.9	836
Collar	360	2.4	11
Bracket (double-arm)	1610	10.7	73
Bracket (single-arm)	980	6.5	44
Ball	730	4.9	10
Cap	12	0.1	0

welding machine was designed and constructed in the field. The top ball is solid, and its weight adds to the stability of the bracket.

FIG. 4—NIGHT ILLUMINATION, PEDRO MIGUEL LOCKS, LOOKING NORTH

The column, pedestal and bracket of the standard are hollow, the core serving as a runway for the wires to the lamps. The ends of the cross-arms are plugged with treated wood to prevent the entrance and nesting of bats, birds and insects. The entire standard is constructed in six pieces—the pedestal, column, collar, bracket, ball and a small cap over the lamp socket in

TABLE II—DISTRIBUTION OF STANDARDS

Location	Single-Arm	Double-Arm	Total
Gatun	116	90	206
Pedro Miguel	80	50	130
Miraflores	101	67	168
Total	297	207	504

the reflector. The double-arm bracket, of course, has an additional cap for the second lamp. In general, all the separate parts were cast at a central plant and assembled in place, usually with a locomotive crane operating on the lock tracks. Joints are grouted after alignment and leveling, except the top ball and cap, which are removable to give access to the wiring. Some of the pedestals, which rest on the back-fill of the locks instead of on solid masonry, were designed with a large

FIG. 5—NIGHT ILLUMINATION, WEST CHAMBER, GATUN LOCKS, LOOKING DOWN-STREAM FROM CENTER WALL

spread base and were cast on the ground integral with the sub-base. In Table I are given the unit quantities of concrete and reinforcement used in the different parts of the standard. The total volume of the double-bracket standard is 96.2 cu. ft. and its total weight 15,524 lb. The total volume of the single-bracket standard is 92 cu. ft. and its total weight 14,875 lb.

There is a total of 504 lamp standards, distributed among the three locks as shown in Table II.

The unit cost of the lamp standards, erected in place, averages as follows:

Excavation	$10.74
Pedestals, column, sub-base and entire erection	227.74
Brackets (average double-arm and single-arm)	35.39
Wiring and connecting lamp and outlet box	13.04
Bronze outlet box	20.81
Socket	1.50
500-watt tungsten lamp	2.87
Two telephone receptacles	.45
One lighting receptacle	.15
Miscellaneous (estimated)	5.00
Total	$317.69

Each lamp standard is provided with an outlet box installed in the concrete pedestal. This outlet box permits the insertion of plugs to connect a portable lamp circuit and a portable telephone circuit. A portable lamp may be required at any moment in the operation

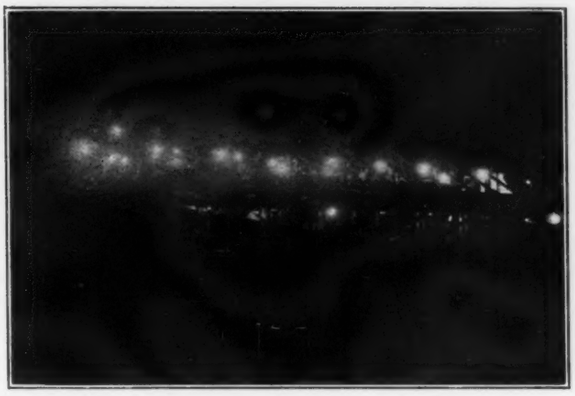


FIG. 6—NIGHT ILLUMINATION, WEST EMERGENCY DAM, GATUN LOCKS; NO REFLECTORS USED

of the locks to light one of the electric locomotive or the deck of a passing vessel. A portable telephone makes it possible for a supervisor of lockages to communicate with the central control house from any position on the lock walls. The outlet is placed in the pedestal of the lamp standard as a matter of operating convenience during lockages, as the standards are accessible throughout the entire length of the lock walls. The box is made of bronze and is provided with a hinged waterproof cover.

The lamps are connected alternately upon separate circuits, providing thereby a duplication of wiring as well as a means of economical operation whenever half the full amount of illumination is desired. All the lighting circuits are remotely controlled by the attendant in the control house, the operating center for all the lock machinery and indicating apparatus. Remote control is accomplished by means of solenoid-operated circuit-breakers, the main contacts of which connect the lamp circuit to the lighting bus of each transformer room, the solenoid being connected to the control wires, which are run from the transformer rooms to the control house. The control circuits, which are carried to a small benchboard in the control house, are connected to relays under the benchboard, the relays being operated by push-button switches on the bench. The push-buttons and relays are so arranged that (1) any individual circuit can be switched on or off, (2) certain groups of switches can be switched on or off, and (3) all the lamp circuits at the locks can be switched on or off by means of the master control switch.

The entire reflector, with lamp and socket, as well as the outlet box in the pedestal, is weatherproof and is suited in every respect to resist the deleterious effects of tropical deterioration.

Interior Illumination

The machinery which operates the gates, valves and other auxiliaries of the locks is housed in small chambers under the coping or top surface of the lock walls. All the chambers are connected by operating tunnels or walkways which extend the entire length of all three main walls, except the approaches and wings. The operating tunnel is comparatively narrow (5 ft. 6 in. in width) and is of low head room (7 ft.). The decking over the operating tunnel is 12 in. thick. The machine rooms have the same head-room as the tunnel, but the decking over these chambers is invariably a removable manhole cover of sufficiently large dimensions to permit the installation and removal of the machinery underneath. It is therefore impracticable to locate lamps in the ceiling of the machine room, and recourse to side-wall illumination is necessary. During the day natural light penetrates to the operating tunnel and the machine rooms through glass prisms which are set in the decking and in the manhole covers.

Tunnel Illumination

On account of the low head-room in the tunnels it was difficult to design a system by which to secure uniform illumination on the floor level. This difficulty has been overcome to a great extent by placing the lamps on 15-ft. centers along the longitudinal axis of the tunnel, alternating the lamps with deck lamps, which latter are also placed on 15-ft. centers. The reflectors are set in the ceiling along the center-line of the tunnel. Forty-watt tungsten lamps are used. Alternate lamps are connected to separate circuits, and groups of ten to twelve lamps are wired on a single circuit from the panelboard, permitting an economical control of the lighting whenever operating conditions are such that half the full amount of illumination is sufficient. The wires for the lighting circuits are run in covered chases, which are formed in the concrete at the upper corner on both sides of the tunnel. The cut-out switches are located in panelboards situated at convenient load centers along the tunnel. The ceiling reflector is of simple design, consisting of inclined surfaces at the four sides to diffuse the light in proper directions. The total number of tunnel lamps is 2041—952 lamps being used at Gatun, 677 at Miraflores and 412 at Pedro Miguel.

Machine-Room Illumination

Approximately 5000 lamp recesses were cast in the concrete walls of the machine rooms at about the level of the eye. A concrete reflector similar to the ceiling reflector, but vertical instead of horizontal, is grouted in the wall recesses. A weatherproof lamp socket designed for a 40-watt tungsten lamp is set into the top of the reflector, and wires are brought to the socket through chases in the walls. In front of the lamp is

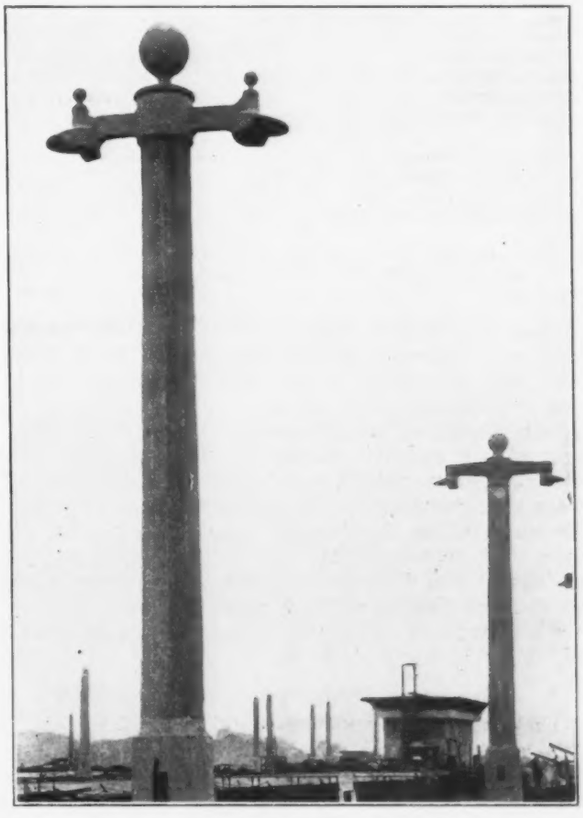


FIG. 7—TRIAL STANDARDS—BRACKET ON SECOND STANDARD APPROVED TYPE

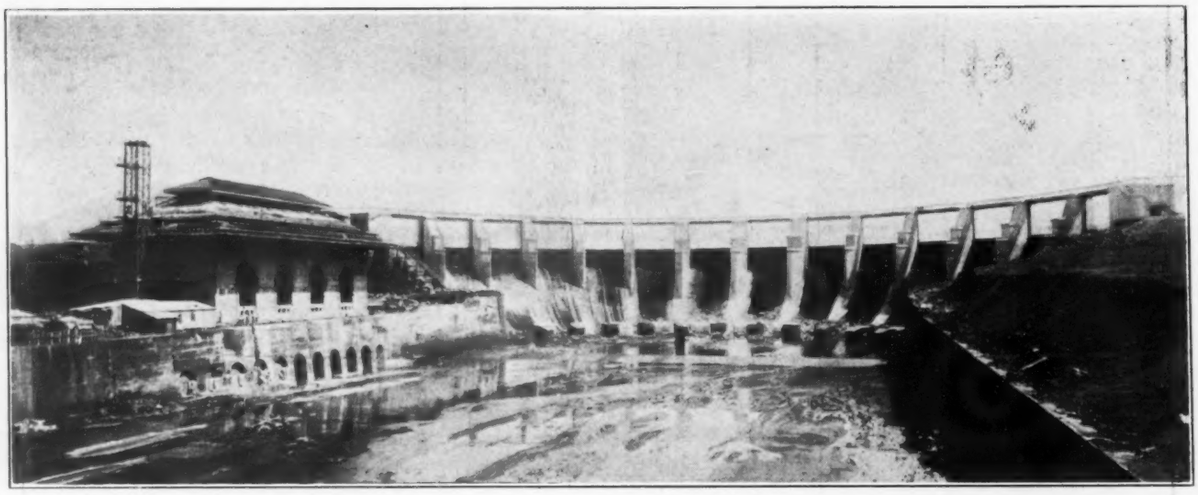


FIG. 8—GATUN SPILLWAY DAM, SHOWING FOURTEEN CREST GATES, OGEE DAM AND BAFFLE PIERS

placed a concrete shade which contains a semi-circular opening at the bottom. The shade is adjusted in a vertical plane to cut off the direct glare of the filament, permitting the light to sift through the opening and flooding the machines with an excellent illumination. The lamp recesses are placed so as to light all sides of the machines contained in the room.

There is a total of 4751 machine-room reflectors, 2101 being used at Gatun, 1524 at Miraflores and 1126 at Pedro Miguel.

The average unit cost of the interior lamp reflectors (tunnel and machine room), as shown by the manufacturing account up to and including December, 1913, is as follows:

	Unit Cost
Cement	$0.0414
Sand	0.0051
Forms (cast iron)	0.0426
Mixing and placing	0.1765
Repairs to forms and equipment	0.0066
Division expense	0.0118
Administrative and general expenses	0.0250
Unit cost—reflector	$0.3090
Lamp (40-watt tungsten)	0.2550
Socket	0.1500
Wiring, connecting, and miscellaneous	0.2420
Total unit cost	$0.9560
Total reflectors manufactured to date	7,575
Total cost	$7,241.70

The work of installing the system of lock illumination was a portion of that assigned to the first division, with Col. H. F. Hodges at the head and Mr. Edwin Schildhauer, electrical and mechanical engineer, in direct charge of the subdivision which designed and erected the exterior standards. The columns of the exterior lamps, including the majority of the pedestals, were manufactured by the former Atlantic and Pacific divisions, while the collars, brackets, balls and caps were cast at the Gatun locks by the lighthouse subdivision. The interior reflectors were manufactured by the first division at the Miraflores locks.

The foregoing information was supplied by Messrs. W. R. McCann and F. C. Clark.

Hydroelectric Development at the Gatun Dam

The permanent supply of electric energy for utilization on the Panama Canal is being generated in the hydroelectric station at the Gatun spillway dam. The tremendous amount of water stored in the artificial Gatun Lake, which is fed by the Chagres River, not only carries vessels the greater part of the way across the Isthmus on a level about 85 ft. above the oceans and provides for raising and lowering them gently through the Gatun, Pedro Miguel and Miraflores locks but also affords an opportunity for the generation of electric energy to light the canal, to operate the gigantic gates and other locking machinery and to drive the locomotives towing ships through the locks.

Electricity will also be used for the coal-handling plants at both ends of the canal, machine shops, waterworks and dry-docks, and possibly in the future to haul trains on the Panama Railroad. To insure continuity of service in case of accident, a steam-electric station at Miraflores, erected a few years ago to supply energy for construction work, will be ready to assume the load when necessary.

The complete equipments for the generating and distributing system on the canal comprise the 7500-kva, 2200-volt hydroelectric plant at Gatun; the 4500-kva, 2200-volt Curtis turbo-generator plant at Miraflores for emergency; a double 44,000-volt transmission line across the Isthmus, connecting Cristobal and Balboa with the two plants; four 44,000/2200-volt substations, stepping down the emf at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying energy; thirty-six 2200/240-volt substations for motor service, traction and light at Gatun, Pedro Miguel and Miraflores locks; three 2200/220-110-volt transformer stations for the control boards at the locks, and stations at Cristobal and Balboa for the coal-handling plants, machine shops and dry-docks.

The Gatun hydroelectric station has a rating of 6000 kw, and provision has been made to increase this rating ultimately to 12,000 kw in case additional energy should be required later for the operation of the Panama Railroad. Three outlet pipes in the dam have been installed along with the original pipe lines to provide for this increase.

Operating Head and Intake

The gross head available from Gatun Lake to mean tide level of the Pacific Ocean varies from a maximum of 91 ft. in the extreme flood times to a minimum of 79 ft., to which level the lake may possibly drop toward the close of the dry season. The plant is designed, therefore, to develop the full water output when operating under an effective head of 75 ft. For three or four months of every year there is absolutely no rainfall on the Isthmus. During this period it is desirable to conserve the water as much as possible, and maximum efficiency was accordingly demanded for the apparatus of both the waterwheel and generator manufacturers.

Water is taken from Lake Gatun through passages 12 ft. wide, fitted with wrought-iron racks 29 ft. 7 in. high to prevent debris from entering the pipe lines. The water is admitted into the pipe lines through three headgates, 10 ft. 6 in. in diameter. These gates are of massive cast-iron construction, the seats where water tightness is required being made of bronze.

Details and Operation of the Gates

Each gate is equipped with two steel stems for raising and lowering. These stems are fitted with bronze nuts working in roller thrust bearings, and the nuts are fitted with steel bevel gears which are operated by a 15-hp, 220-volt alternating-current motor with a speed of 750 r.p.m. The motor is placed between the stems and has shaft extensions on each side which carry two bevel pinions that engage the bevel gears on the stem nuts. The stands which carry the stem nuts are equipped with a hand operating mechanism, which can be disconnected when the gate is operated electrically.

The gates are equipped with automatic control devices, consisting of a limit switch geared to one of the gate stems and a float switch actuated by the water in the pipe. When the gate has opened a sufficient distance so that the pipe line can be filled in about five minutes, the limit switch opens the circuit and stops the motor. The gate remains in this position until the pipe line is filled and the water rises in the 36-in.-diameter air-vent pipe just below the gate. A float switch is then actuated and the motor circuit is again closed. The gate is raised clear of the opening, when the limit switch again operates to prevent over-travel. The gate is closed by reversing the main switch at the power house, and the limit switch again stops the motor when the gate has reached the closed position. In case the circuit should be opened two men can operate the gates by hand.

Each of the gates is bolted to a pipe line having a diameter of 10 ft. 6 in. and an average length of 420 ft. The pipe lines are made of $\frac{3}{8}$-in. steel plates in courses 8 ft. long, each course being made of three sheets to form the circumference. The center of each course is fitted with a 3-in. by $\frac{3}{8}$-in. Z-bar ring, which is also made in three sections. After the pipe was riveted together at the plant, the outside was covered with a layer of reinforced concrete to prevent rust.

The pipe lines are led down to the rear of the power house on a uniform slope from the spillway and are connected to the turbines in the power house through 90-deg. bends with radii of 70 ft. A Pitot-tube testing apparatus can be attached to each of the pipe lines while the unit which it serves is in operation. A pair of portable tubes for taking readings in planes of the pipe at 90 deg. from each other has been supplied for this service.

The hydroelectric station is 61 ft. wide and 137 ft. long and has an extreme height of 74 ft. The building is designed on the unit principle to admit of future extension, and consists of a single room open to the roof, exposing the trusses on which are laid the reinforced-concrete roof slabs, which, in turn, support the red Spanish tiles. The walls are of poured concrete and are 30 in. thick to the level of the crane rails near the cornice. The exterior overhang of the main roof is 13 ft. 2 in. and that of the monitor roof 4 ft. 8 in., the exceedingly large projections having been generally adopted for all the permanent buildings in the Zone as a shelter from tropic rains as well as from the heat of the sun. Beyond the general use of tile for flooring and an interior white enameled-brick wainscot 14 ft. high to relieve the coarseness of the walls, there is no difference in the finish of the concrete surfaces within and without.

The interior has four principal floors, namely, a pit for the three 2500-kva hydroelectric turbines, a main floor and two galleries. The turbine pit, with an area of over 2100 sq. ft., is 6 ft. below the level of the main floor and is reached by iron stairways descending alongside the turbines. From the pit other stairs lead down to the storeroom on the north side and to the air-compressor and oil-pump compartments at the ends. The pit is lined with white-enameled brick.

The main floor is divided into two parts, one being partitioned off and devoted to the use of the electrical equipment and the other forming an uninterrupted passage on the longitudinal axis of the building, terminating with two large entrance doors at either end. Easy access to railway cars is afforded by means of a track which enters this floor from grade through the

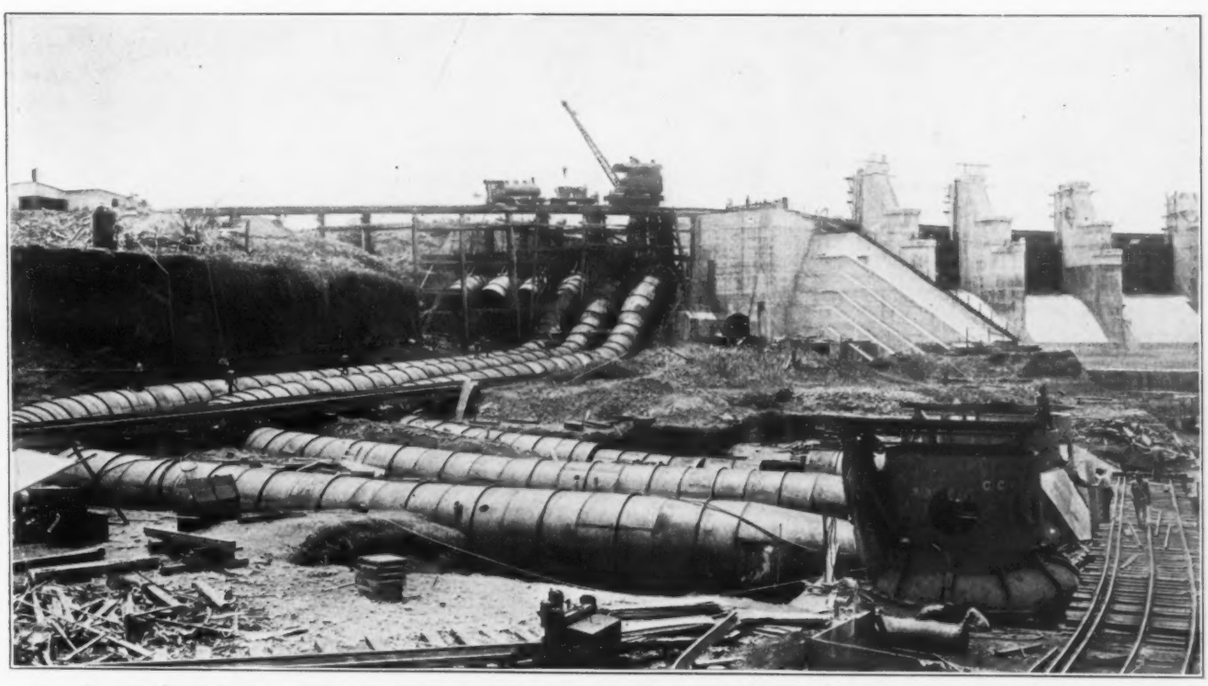


FIG. 9—HYDROELECTRIC INSTALLATION UNDER CONSTRUCTION, SHOWING PIPE LINES AND TURBINES ERECTED

northwest door, thus giving every facility for handling heavy machinery by the 30-ton electric crane running the length of the building overhead.

Concrete stairways at either end of the building give access to the mezzanine and second galleries, which are

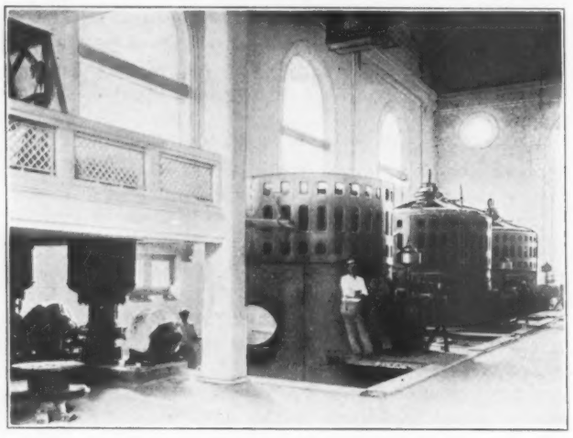


FIG. 10—INTERIOR VIEW OF HYDROELECTRIC STATION

devoted to the switchboards, oil-switch compartments, reactance coils and other electrical equipment. Two such galleries extend the entire length of the station on the northeast side, and in the south corner are superimposed two smaller ones used as a machine shop and an office respectively. The sashes in the large side wall windows are operated in sections by a hand-gear system, and the continuous bottom-hinged sash in the roof monitor is operated by motors.

Details of the Installation

Each of the three 2000-kw main generating units in the hydroelectric station is driven by a 50-in. vertical, single-runner Francis turbine manufactured by the Pelton Water Wheel Company. Each turbine has a maximum rating of 3600 hp when operating under an effective head of 75 ft. and at a normal speed of 250 r.p.m. The turbines are at such a height that the center of the runners is 20 ft. above tailwater.

The water is discharged through steel-lined concrete draft tubes, which are 71 in. in diameter at the point where the water leaves the runners, and they increase in size until at the outlets they have an elliptical section of 9 ft. by 17 ft. Each of these tubes has 90-deg. bends so that the outlets are horizontal. The linings are made of ¼-in. steel plates, which were fitted together in the shop and shipped "knocked down."

The turbines are of the spiral-case type and are fitted with heavy cast-iron distance rings which carry the generators. The weight of the revolving parts of each generator and turbine is carried on a roller thrust bearing mounted on top of the generator. The turbine is designed so that the runner exerts an upward thrust of 20,000 lb. when working at its full rated output, thereby relieving the thrust bearing of that amount of load.

Oil for the thrust bearing is supplied by a small pump geared to the main turbine shaft, and a tank is provided below the pump to receive the overflow from the bearing. In this way a constant circulation of oil is maintained. As this oil returns to the suction tank it passes through the lower guide bearing on the main shaft and lubricates the shaft.

The runners of the turbines are made of a special bronze and weigh approximately 7000 lb. each. These runners are bored so that they taper, and are held in place on the lower end of the shaft by means of bronze nuts. The surfaces of the runner vanes are hand-finished to reduce hydraulic losses.

The speed of the turbines is controlled by Pelton oil-pressure governors, which are mounted on the distance rings and are driven by bevel gearing from the main shaft. Tachometers are mounted above the governors on supports bolted to the distance rings. The tachometers are directly connected to the governor heads.

Small electric motors are connected to the governors and are used for varying the speed of the main units for synchronizing purposes. A device is also provided on each governor for varying the permanent drop in speed from no load to full load. This device can be adjusted for any variation from a 5 per cent drop in speed to absolutely constant speed and from friction load to maximum load. The governors are also fitted with a hand-control mechanism for adjusting the gates independently of the oil pressure.

The pressure oil for actuating the governors is supplied by two Pelton rotary pumping units, driven by 10-hp alternating-current motors at a speed of 375 r.p.m., each pump being capable of serving the governors on all three units. The governors work on an open system, no vacuum chambers being used. The discharge oil from the governors is led into oil sump tanks, from which it passes into the suction of the pumps. Each oil pump is connected to a steel pressure oil receiver with an air space above the oil. The oil sump tanks and pipe connections are installed in duplicate and valves are provided to enable one set to be cleaned while the other is in service.

The three main generating units are of the vertical revolving-field type, each being provided with a directly

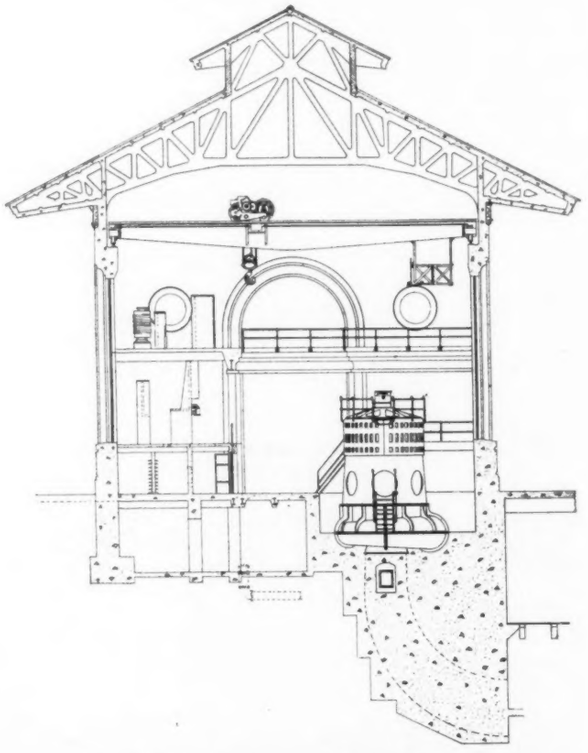


FIG. 11—CROSS-SECTIONAL VIEW OF GATUN STATION

connected exciter. The generators were manufactured by the General Electric Company, and are designed for three-phase, 2200-volt, twenty-five-cycle current with a continuous rating of 2000 kw at 0.8 power-factor.

The exciters are rated at 50 kw, with 125 volts pres-

sure and each is capable of furnishing exciting current for two generators under the maximum guaranteed load. The generator and exciter for each set weigh approximately 65 tons.

The generators are carried on heavy cast-iron dis-

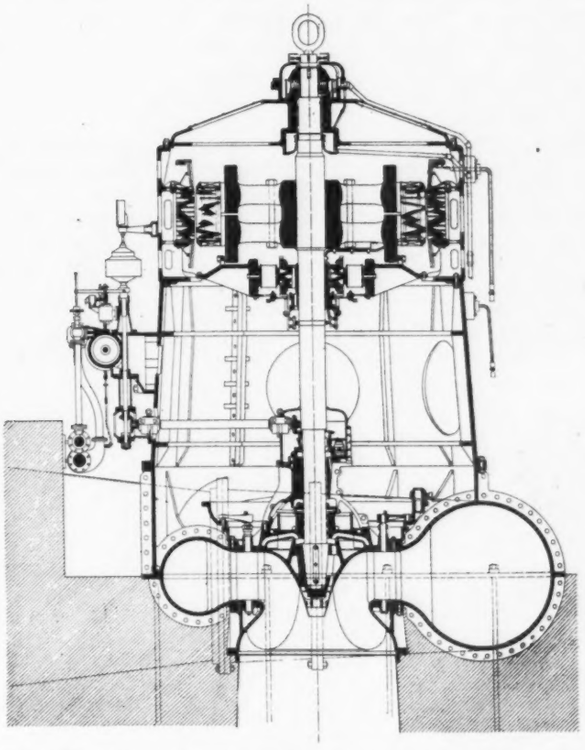


FIG. 12—CROSS-SECTION THROUGH WATERWHEEL, GENERATOR AND EXCITER

tance rings furnished by the Pelton Water Wheel Company, and the stationary armatures are bolted to these rings. The thrust-bearing and upper-guide-bearing support consists of a very rigid iron casting bolted to the top of the stationary armature.

The thrust bearings are of the roller type, manufactured by the Standard Roller Bearing Company, Philadelphia. These bearings carry the weight of the complete revolving element, consisting of the generator field, core exciter armature and turbine runner, which are mounted in the order given on a one-piece shaft. The weight thus suspended is 32 tons. The exciter magnet frame is supported by lugs cast on the stationary armature of the main generator.

The exciter is readily accessible through large holes in the distance ring, a platform being provided inside the ring from which the exciter commutator and generator collector rings may be reached. Provision is made for securing the magnet frame of the exciter to the revolving element of the generator, so that the complete rotating element, together with the exciter frame, is raised at once in disassembling. For inspection of the roller bearing it is necessary simply to remove a speed-limiting switch from the top of the shaft and the upper half of the bearing housing. There are two guide bearings, one immediately below the thrust bearing, furnished with the generator, and the other above the waterwheel, furnished by the waterwheel builder. The arrangement of the complete unit is shown clearly in the cross-sectional view.

The generators, under official tests, at 80 per cent power-factor, showed an efficiency of 95.1 per cent when taking 2000 kw, 94.3 per cent with 1500 kw, and 92.5 per cent with 1000 kw. The guaranteed temperature rise of 40 deg. C. above room temperature, of 25 deg. C. under continuous operation at full load and of 55 deg. C. after two hours' run at 25 per cent overload was met with an ample margin.

Current-limiting reactors were provided to give 5 per cent reactive drop, with three-phase, twenty-five-cycle current at 2500 kva and 2200 volts. While the generator windings are sufficiently rigid to withstand the strain of a short-circuit under full load, these reactors will reduce the shock on the windings and will also make the operation of synchronizing the machines easier and safer.

In addition to the directly connected exciters, two motor-driven exciters are used. These consist of a 100-kw, 125-volt, 500-r.p.m. generator directly connected to a 150-hp, 2200-volt, twenty-five-cycle squirrel-cage induction motor. The set is mounted on a single base plate and is provided with three bearings. These exciters can also be used for charging the control battery.

On account of the great distance, covered energy is transmitted at a pressure of 44,000 volts from the stations to both ends of the canal. The step-up transformers are, however, not in the generating stations, but in substations in their vicinities; therefore the plants generate and distribute only 2200-volt energy.

The system of connection throughout is based on the double-bus, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit. This system was naturally selected for this station because it was considered the most flexible for the requirement of uninterrupted service.

The main switchboard is of the benchboard type, with vertical rear board for relays, watt-hour meters, graphic instruments and the control-battery equipment. The switchboard and all control apparatus were built by the General Electric Company. The space between the front and the rear boards is inclosed by grille work

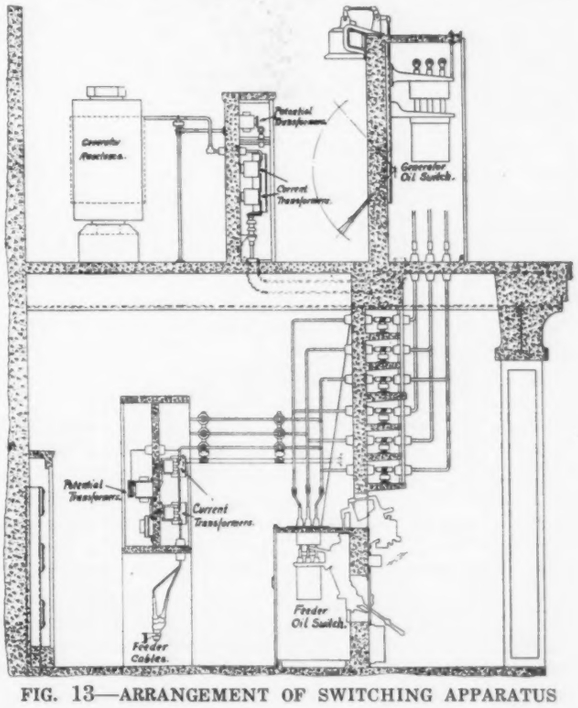


FIG. 13—ARRANGEMENT OF SWITCHING APPARATUS

with doors at both ends, and a metal molding extending along the floor and the top of the board gives a finished appearance to the whole. On the top of the switchboard is a second story, for the electrically controlled generator and exciter rheostats, and it is accessible by

means of a ladder inside the structure. The first panel from the left in the benchboard controls the exciters, the next three the generators and the remaining four the twenty-four feeder circuits. The system of connection is represented by dummy buses of polished copper on top of the bench. In the interior of the benchboard are the operating buses and fuses, potential buses, instrument resistors, and the channel-iron risers with distributing tubes which carry the instrument and control leads to their points of connection on the board.

A generator-voltage regulator, which is transferable to either of the two sets of buses, is installed on a separate pedestal which also carries the synchronism indicators and clock.

As mentioned above, the exciters are controlled from the benchboard, but the electrically operated exciter switches and field switches are mounted on a separate board placed so as to make the exciter connections as short as possible. This arrangement eliminates the exciter buses and the main connections from the control board, but leaves the control of the whole equipment in the hands of the operator.

The bus and switch compartments are on two galleries. On the upper gallery are the control board, which is near the end of the station that may be extended, the generator reactances, a compartment for generator-current and generator-potential transformers, and the generator oil switches. From the oil switches connections are made through the floor to the buses on the gallery below, on which gallery are also the feeder oil switches and the compartment for the instrument transformers and cable bells. On the main floor just below this gallery is the cable vault with racks for the feeder cables.

All compartments are built of concrete with fireproof doors. The buses and connections are made of solid-copper rods of sufficient size to give a rigid construction even where the amount of energy carried is very small. After being installed, the buses and connections and all joints were heavily insulated with varnished cambric to make them perfectly safe.

All the 2200-volt oil switches are solenoid-operated and are provided with a mechanism for disconnecting them easily for cleaning or repairs. The live parts of these switches are completely covered. For the hand-operated switches a pipe framework is used to support vertical metal guides which carry the oil-switch operating mechanism and the slate base forming a section of the switchboard panel. On the guides a lever and toggle mechanism is mounted, by means of which the oil switch and slate base may be raised and lowered.

A stationary cast-iron base mounted on the pipe framework above the oil switch carries the disconnecting switch studs and insulators. The high-tension leads run to the tops of the disconnecting switch studs, and the bottom of each stud is equipped with contact fingers. On the top of each oil switch stud is mounted a contact blade. When the oil switch is raised these blades engage the contacts on the bottom of the disconnecting-switch studs, which thus in the closed position form extensions of the oil-switch studs. The disconnecting-switch contacts are surrounded by insulating shields which prevent accidental contact. When the oil switch is lowered it is completely isolated from the circuit. When the oil switch is raised it always goes to a fixed height where it is latched. An interlock prevents the oil switch from being raised or lowered unless its contacts are open, thus precluding the possibility of the circuit being closed or opened by the disconnecting switch. In some instances another interlock makes two single-throw switches a double-throw switch and prevents both switches being closed at the same time.

For solenoid-operated switches the same form of disconnecting switch is used, but the solenoid is stationary, and the connecting mechanism to the oil switch has a vertical slotted link that allows the oil switch to be raised and lowered without being disconnected from the solenoid mechanism. A mechanical interlock prevents the raising or lowering of an oil switch while in the closed position.

The complete hydraulic equipment for this installation, including the racks, headgates, pipe lines, Pitot-tube testing apparatus, turbines, governors and oil-pumping units, was designed and built by the Pelton Waterwheel Company, and all the electrical apparatus, including the generators, switchboards, transformers, headgate motors, limit switches, float switches, accessories and motors for driving the oil pumps, was designed and built by the General Electric Company. The details of design and manufacture of all this apparatus were subject to the approval of the Isthmian Canal Commission's engineers.

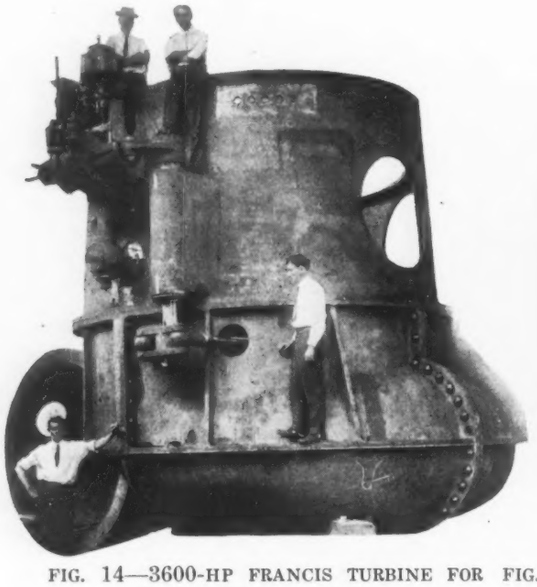


FIG. 14—3600-HP FRANCIS TURBINE FOR HYDROELECTRIC STATION

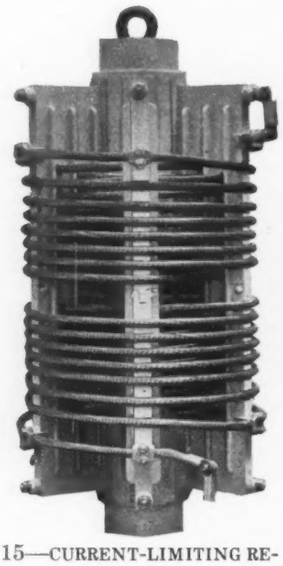


FIG. 15—CURRENT-LIMITING REACTOR WITH CONCRETE CORE

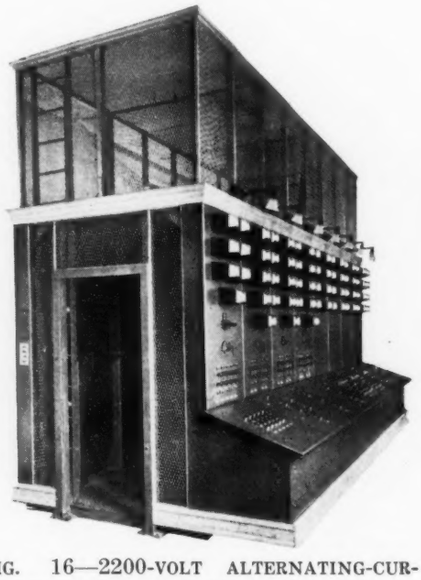


FIG. 16—2200-VOLT ALTERNATING-CURRENT INSTRUMENT AND CONTROL BOARD

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Sweatshop Conditions Bettered by Electricity

Evidence of the progress made by the Joint Board of Sanitary Control in bettering the conditions existing in New York sweatshops is shown by the increasing rate at which these places are adopting electricity for lighting and machine drive. In July, 1911, only 199 of the 779 shops south of Houston Street, New York, used electricity, while in the next six months 310 were provided with electric service. Six hundred and fifty shops are inspected by the board biennially under summer and winter conditions. While electric light is fast replacing other forms of illumination, most of these shops are being remodeled so that artificial lighting is not needed in the daytime. The board has also performed a great service by revising the lighting of these shops to meet the requirements of operating conditions. Lamps and reflectors are prescribed which will give the proper intensity and distribution. Advice is also given as to the proper location of the units so that each worker will receive the proper amount of illumination.

Two Exhibit Booth Novelties at North Adams, Mass.

At the recent electrical show given by the North Adams Gas Light Company, which supplies electrical energy in North Adams, Mass., two ingenious devices for attracting and holding the public's attention were used.

One was a graphical device demonstrating the cost of energy. The names of different household appliances were placed on a large board labeled "Cost Meters." Before and after the name of each appliance was a red lamp. On the bottom of the board were a "cost meter" and a demand wattmeter. As each appliance in the booth was used its red lamp was lighted and the two meters showed respectively the cost per hour and the watts demand of that appliance.

The other novelty display device was a large clock with a single hand, driven by a fan motor and having on the face numbers from 0 to 400. As the arm came opposite a number its corresponding lamp was flashed. The clock motor was automatically started, controlled and stopped by an Anderson time switch. To each person entering the hall a number was given, and he was informed that the clock was set to stop at a given hour. The person holding the number showing the time at which the hand stopped was given his choice between two appliances and a table lamp.

FIG. 1—METERS SHOWING COST OF OPERATING HOUSEHOLD APPLIANCES

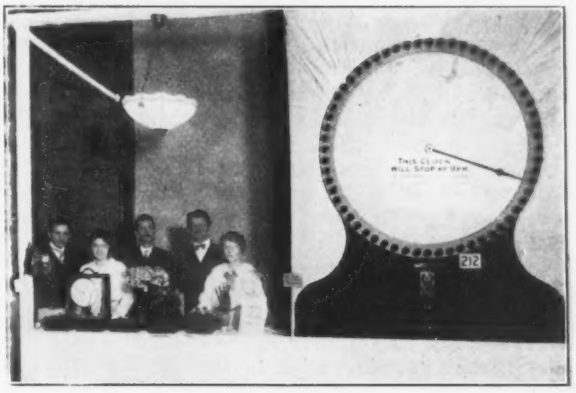


FIG. 2—MOTOR-DRIVEN CLOCK HAND

The Public Utility and the Newspaper

In the relation of the corporation to the newspaper is a power which may be made an asset and a valuable ally, said Mr. F. R. Slater in a broadly considered address on "The Public Policy of Public Utility Corporations" delivered before the Southwestern Electrical and Gas Association at Galveston, Tex.

"The reporter or news-writer," continued the speaker, "is the one who has the ability and the opportunity to put thoughts into the minds of thousands of men and women every day, the people from whom we derive our revenue; the people who select those who make the laws which govern us; the people who sit in judgment upon our acts and behavior. This is a power whose importance can hardly be overestimated. And when it is recalled that the average reporter who consciously or unconsciously wields this power must be a man of good character with a keen and analytical mind, and further that he must be possessed with the invaluable asset of being able to make friends, and that this same reporter in his every-day work is continually coming into contact with your manager and company representatives, and that he is actively interested in all live questions and occurrences, it would seem a serious error if he should not receive respectful attention, to the end that a bond of confidence may be established between him and you, and thus the story which he is preparing for the paper will give true conditions and facts.

"In the course of events you will have accidents on your system, affecting the public either through bodily injury or inconvenience. The attitude of your officers toward the press at this time is of the greatest importance to the welfare of your company. If the situation is handled from the viewpoint that the occurrence is purely a company affair, every mouthpiece of the cor-

poration may be closed to the newspaper. If, on the other hand, the situation is handled from the viewpoint of one who realizes that the public is entitled to at least a word of explanation, the reporter will be given such information in such a way that the account of the accident will be written in a spirit of fairness. He will not so shape what he says that everyone who reads it will instantly jump at a conclusion that the company wishes to avoid; he will not set in motion in 10,000 or 50,000 minds a current of thought that in the next year or the next decade will accumulate to proportions which will actually wipe out the company's dividends. The first impression is an all-powerful factor in all of the subsequent thinking that is done with reference to that event, and the company which does not improve the means to have these first impressions at least fair is missing a large opportunity.

"There is an inherent belief in everybody that where there is fear there is wrong, and thus the repeated statement that a company is keeping something under cover poisons the public mind against the company. Public opinion to-day may not be a newspaper opinion, but it is the creature of newspaper opinion. Public knowledge is disseminated through the press, and it is on the facts as they appear in the news columns of the country that public opinion is based. We may deny and decry the power of the press, but as long as people read newspapers, even newspapers whose policies they do not respect, they will be influenced by them. Do not forget that 'the mind is like a sheet of white paper in this—the impressions it retains longest are the blackest.' "

Pumping Gravel from Riverbed to Railroad Cars

The Hattiesburg (Miss.) Traction Company has on its lines several gravel-pumping outfits which offer, from the central-station standpoint, a very desirable class of long-hour business. One of these installations is unusual in the respect that at a single operation it takes the gravel from the riverbed, washes it clear of smaller particles, and loads it onto the railroad cars ready for shipment. The 10-in. centrifugal pump used is driven by a 100-hp slip-ring induction motor and conveys the

FIG. 1—PUMPING GRAVEL OUT OF RIVER

FIG. 2—FLOAT ON WHICH PUMP AND MOTOR ARE INSTALLED

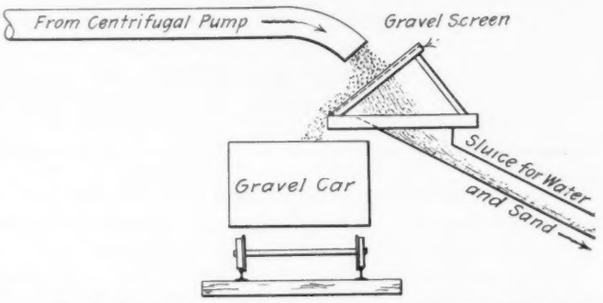


FIG. 3—PUMPING GRAVEL FROM RIVERBED TO RAILROAD CAR

dredged mixture (gravel 5 per cent, sand 10 per cent and water 85 per cent) over a horizontal distance of 450 ft. with a vertical lift of 35 ft. to 65 ft. measured from the riverbed. A sloping screen is mounted over the car, and against this the pipe-line spout discharges. The gravel is thus separated out and falls into the car, while the water and the smaller solid particles pass on through the screen and down a sluiceway. By means of a settling pond the sand is here recovered and is also sold for building purposes.

This gravel-loading plant runs twelve hours a day. About 3.5 kw-hr. is consumed for each ton of gravel handled. Forty to fifty minutes is required to load a car. The rate for this service is 2.5 cents per kw-hr.

Short-Cut Accounting Methods for Small Central Stations

A number of short-cut methods are in use by the accounting department of the Vicksburg (Miss.) Light & Traction Company, where with a limited staff from 1200 to 1500 electric service bills are sent out monthly. About 80 per cent of the company's customers run mer-

Acct. No.....

No. .....Street.

CUT IN	CUT OUT
Meter Order No.....	Meter Order No.....
Line Order No.....	Line Order No.....
	Reason.....

FIG. 1—CUSTOMER'S APPLICATION CARD, CONTRACT ON REVERSE SIDE

chandise accounts in addition, a feature which has required the development of special methods to minimize the detailed labor usually accompanying this class of bookkeeping.

The card on which the customer makes application for service is of filing size (4 in. by 6 in.) and bears on its reverse the contract form. After having entered upon it the customer's address, account number, credit confirmation, etc., this card forms a part of the card index to the "consumers' ledger." This ledger is arranged geographically by street location and is of the loose-leaf form, being made up of three sheets to each ten accounts. The long sheet contains the customer's

account number, name, address, meter constant, rate, meter number and size, date cut in, etc. Each of the ten account spaces has five lines. The short sheets, which fold into alignment with the original data on the long sheet, contain spaces for twelve months' accounts, three to each page. Each such space is divided into columns for meter readings, consumption, net charges, date of payment, amount brought forward, discount added and date of payment. The short sheets are replaced every twelve months, but the long sheets will last indefinitely, since they contain only data of record. In case such a long sheet becomes full it can be immediately replaced by a new sheet, in this way avoiding the necessity for transferring the whole ledger at the end of the year, as would be required with a bound ledger.

After the consumption and charges for a given month have been entered in the ledger, each page is totaled and these totals are entered in the "recapitulation book," which is ruled similarly to the short ledger sheet. This book aids in carrying out the balancing of the ledger and shows the total kilowatt-hours sold to customers, the total charges for this energy, the total collections during the month, and the total to be carried forward to the next month. When an error has been made the use of this book also makes the fault easier to locate and correct than if the totals are carried from one page to the next through the ledger. Only "live" accounts are kept in the consumers' card-index file. When a customer discontinues service his card is removed.

As soon as the ledger account has been opened a meter reader's slip, bearing the consumer's name, address, meter location, number, size, etc., is made out and put in the reader's book. The form of slip used has spaces for thirty-six months' or three years' readings, and the names of the months are printed in inverted order, beginning at the bottom of the sheet with January, in order to facilitate subtraction of dial readings.

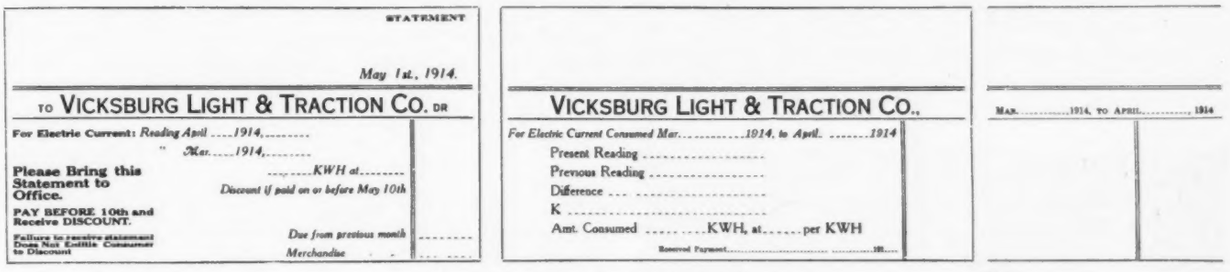
The form of customers' bill used at Vicksburg has been especially designed to serve a central station handling a large merchandise business, as does the local company. The bill form is in three parts—the statement, the receipt and the cashier's stub. All three are filled out simultaneously on an addressograph. The statements are mailed in transparent-faced envelopes, reducing the work of addressing. If the customer owes a balance on merchandise purchased, the merchandise bill itself is held in the company's office until paid, but each month the balance due on this bill is entered on the lighting statement, so that the customer receives frequent reminders. The Vicksburg company saves much time during the billing period by making use of a set of calculating stamps. These consist of separate rubber markers, each showing the gross bill for a given kilowatt-hour consumption and also the discount and net bill if paid within the discount period. If, for example, the customer has used 25 kw-hr. during the month the accountant has only to pick up the stamp so marked and with it print directly on the statement the gross and net amount of the bill and the discount.

The statements are torn off and sent out, while the receipt and stub are filed in a cabinet at the cashier's window. If a merchandise account is pending against the customer, that bill is also pinned to the lighting receipt form. The receipts and stubs are easily found by the arrangement of numbered pigeonholes.

At the close of each day's business the cashiers' stubs are collected and assorted in numerical order.

Then under each class of collection the stubs are totaled on an adding machine, and in each case this printed listing is wrapped about the stubs under an elastic band, stubs and listing being filed together in a special clasp envelope. On the face of these envelopes blank forms are provided applying to the electric-service department of the company's business as follows: Accounts received, cash sales, meter deposits, suspense accounts and miscellaneous receipts. These totals are then copied into the cash book, while posting to the ledger is done from the cashiers' stubs. After having been posted, the stubs are filed away in their envelope for reference.

Mr. C. G. Johnson is manager of the Vicksburg Light & Traction Company and Mr. L. W. Wade is local auditor.


STATEMENT

May 1st, 1914.

TO VICKSBURG LIGHT & TRACTION CO. DR

For Electric Current: Reading April ....1914,.....
" Mar.....1914,.....

Please Bring this Statement to Office.

.....KWH at.....

Discount if paid on or before May 10th

PAY BEFORE 10th and Receive DISCOUNT.

Failure to receive statement Does Not Entitle Consumer to Discount

Due from previous month .....
Merchandise .....

VICKSBURG LIGHT & TRACTION CO.

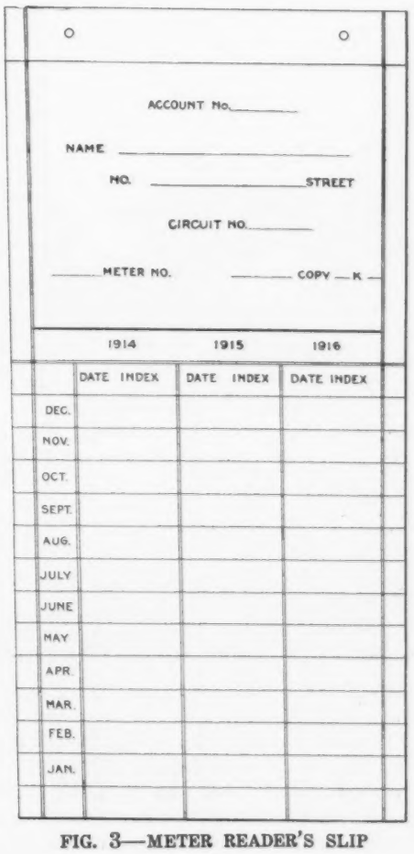
For Electric Current Consumed Mar.....1914, to April. 1914

Present Reading .....
Previous Reading .....
Difference .....
K .....
Amt. Consumed .....KWH, at.....per KWH

Received Payment.....1914

MAR. .....1914, TO APRIL.....1914

FIG. 2—FORM OF CUSTOMER'S BILL


ACCOUNT No._____

NAME _____

NO. _____STREET

CIRCUIT NO._____

_____METER NO. _____ COPY — K —

	1914	1915	1916
	DATE INDEX	DATE INDEX	DATE INDEX
DEC.			
NOV.			
OCT.			
SEPT.			
AUG.			
JULY			
JUNE			
MAY			
APR.			
MAR.			
FEB.			
JAN.			

FIG. 3—METER READER'S SLIP

Illumination and Wiring

Installing Steel-Taped Cable Arc-Lamp Circuits Along Paved Streets

The work of installing Milwaukee's 200 new inverted flame-arc lighting standards has been completed, the entire system having been placed in operation for the first time on Jan. 30. These series lamps, mentioned in the Jan. 24 issue of the *Electrical World*, are recent products of the Adams-Bagnall Electric Company and are rated at 3500 cp each. When lighted, each lamp requires a current of 10 amp, operating with a potential of from 46 volts to 48 volts across the arc. Thus each unit takes approximately 480 watts for its operation. Sixty-cycle energy for the lamps is supplied at 2400 volts from constant-current transformers.

The accompanying construction photographs convey an excellent idea of the methods employed in carrying out the work incident to the erection of such a street-lighting installation where steel-taped cable instead of conduit is used to inclose the copper conductor. In this instance the cable contained a single No. 5 wire. Fig. 1 is a view taken after the rods which hold the ornamental lighting standard in place had been anchored to the concrete sidewalk. Where it was impossible to place bolts through the sidewalk, holes were drilled in the concrete somewhat larger than the ends of the rod, so that lead could be used for calking to hold the rods in place. The iron conduit shown in the excavation (Fig. 1) was laid when the original paving was put in, and through this the lead-covered cable was conducted from the first lighting standard of the circuit to the manhole near by. Using this type of manhole entrance saved the labor of constructing a new manhole joint for the steel-taped cable.

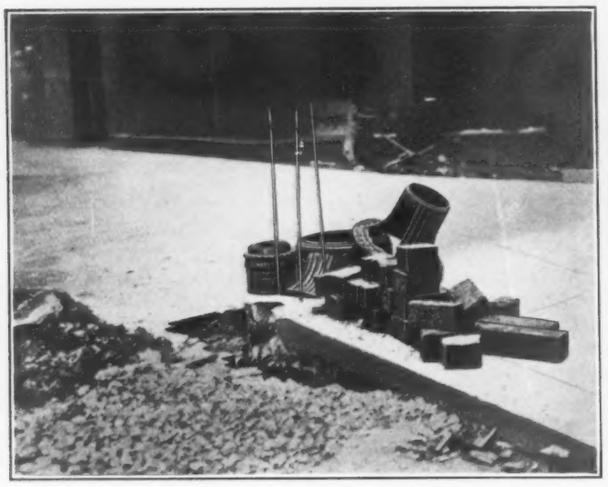


FIG. 1—FIRST OUTLET; RODS FOR STANDARD IN PLACE

FIG. 3—REPLACING PAVING BLOCKS NEAR OUTLET

In Fig. 2 the construction crew is shown in the act of laying the steel-taped conduit. This picture also shows how very little of the pavement need be removed. Where there are no obstructions along the curb one line of paving block has been removed and the cable has been laid directly upon the concrete foundation of the street. Where catch-basins or other obstructions are encountered the cable is taken around these by removing as few paving blocks as possible and taking out the sand cushion, which rests on the concrete foundation of the pavement.

When the cable has been laid upon the concrete foundation and the sand cushion replaced the paving blocks are relaid alongside the curb. Fig. 3 shows a workman in the act of replacing these blocks and also illustrates the method used for taking the cable through the curb into the lighting standard. As will be seen, the concrete curb is chiseled away, permitting the entrance and exit

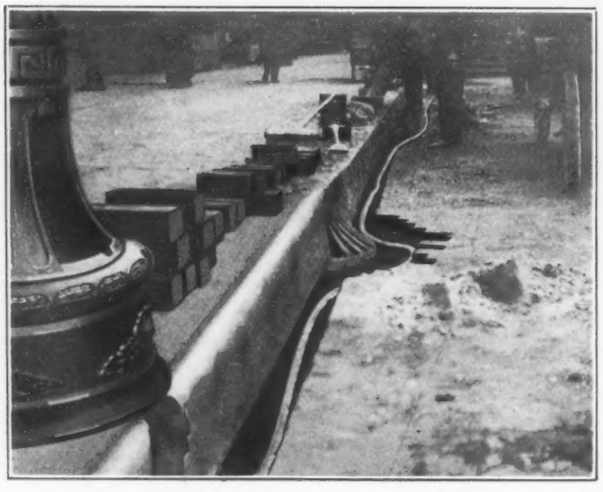


FIG. 2—LAYING SINGLE-CONDUCTOR STEEL-TAPED CABLE

FIG. 4—SEALING OPENING WITH PITCH COMPOUND

of the conductor at the level of the pavement occupied by the sand cushion. After the paving blocks have been replaced on top of the customary sand cushion, the opening which has been made is sealed by the use of a pitch compound poured between the creosote paving block and the curb line and also into the cracks between the blocks themselves. These operations render

FIG. 5—NIGHT SCENE. INVERTED FLAME-ARC LAMPS

the paving almost as good as new and are certainly an improvement over the older open-trench method, in which, in addition to the removal of the paving blocks, the concrete foundation of the street was uprooted, invariably leaving on replacement a low place in the paving to become wider and wider as the heavy traffic pounded the paving blocks at the edge of the depression.

Spacings of 50 ft. to 60 ft. have been used between the ornamental corrugated shafts which support the lighting units. The lighting effect produced by placing these lamps between the arc lamps on the street railway trolley poles and the ornamental tungsten lamp standards is shown in Fig. 5, a night view taken just after the installations were completed.

The entire expense of installing these units and the cost of their operation in the future will be borne by the merchants whose property fronts on the streets

FIG. 6—NIGHT ILLUMINATION, INVERTED FLAME-ARC LAMPS

which have been lighted. According to the terms of the plan on which the lamps have been placed in operation, the Commonwealth Power Company purchased the units, supplies energy for the lighting and maintains the lamps. In return, the electric service company collects 15 cents per month per front foot from each merchant on the improved thoroughfare.

ILLUMINATION OF CLEVELAND ELECTRIC COMPANY'S BUILDING

A striking departure from the several prevailing types of exterior illumination has been adopted to light the exterior of the Cleveland Electric Illuminating Company's new office building. Previously it has been a general practice to make exterior illumination a part of the architectural scheme of buildings. In this installation, however, an effort has been put forth to conceal anything suggesting illumination, and, as will be seen from the accompanying picture (Fig. 1), a daylight view of this building reveals no electrical fixtures. In selecting this type of installation the officials of the company had in mind the fact that at some future date any particular type of lighting installation selected to-day might become obsolete. Such becoming the case, the operation of these lamps may be discontinued without affecting the architectural beauty of the structure, and if desirable another installation may be made of the type then in vogue.

Exterior Lighting from Within

Referring to Fig. 3, the method of concealing the lighting fixtures in the terra-cotta cornice is shown in

FIG. 1—NEW BUILDING OF CLEVELAND COMPANY

cross-section. Each panel between the brackets supporting the cornice was left blank when the terra cotta was cast and was later closed by a metal sash containing two panes of translucent glass, each 0.375 in. thick. Placed above each metal sash are two reflectors, each inclosing two 100-watt tungsten lamps, energized from a plug socket in the upper part of the hollow cornice. The reflectors themselves are not fastened in any way, but may be picked up, removed through the 24-in. opening, and carried into the attic floor when lamp renewals or cleaning makes it necessary. The translucent-glass window may be cleaned on both sides by simply raising the sash about the hinge shown at the outer corner of the cornice. There are just 100 bays in the entire cornice, each bay being lighted with four 100-watt lamps, making the connected load of the entire installation 40 kw. It is said that the cost of the installation was but slightly more than what would have been the price of the solid terra-cotta casting. Of the lighting effect produced, it may be said that it is quite pleasing to the eye, and makes the red brick and white terra cotta of the

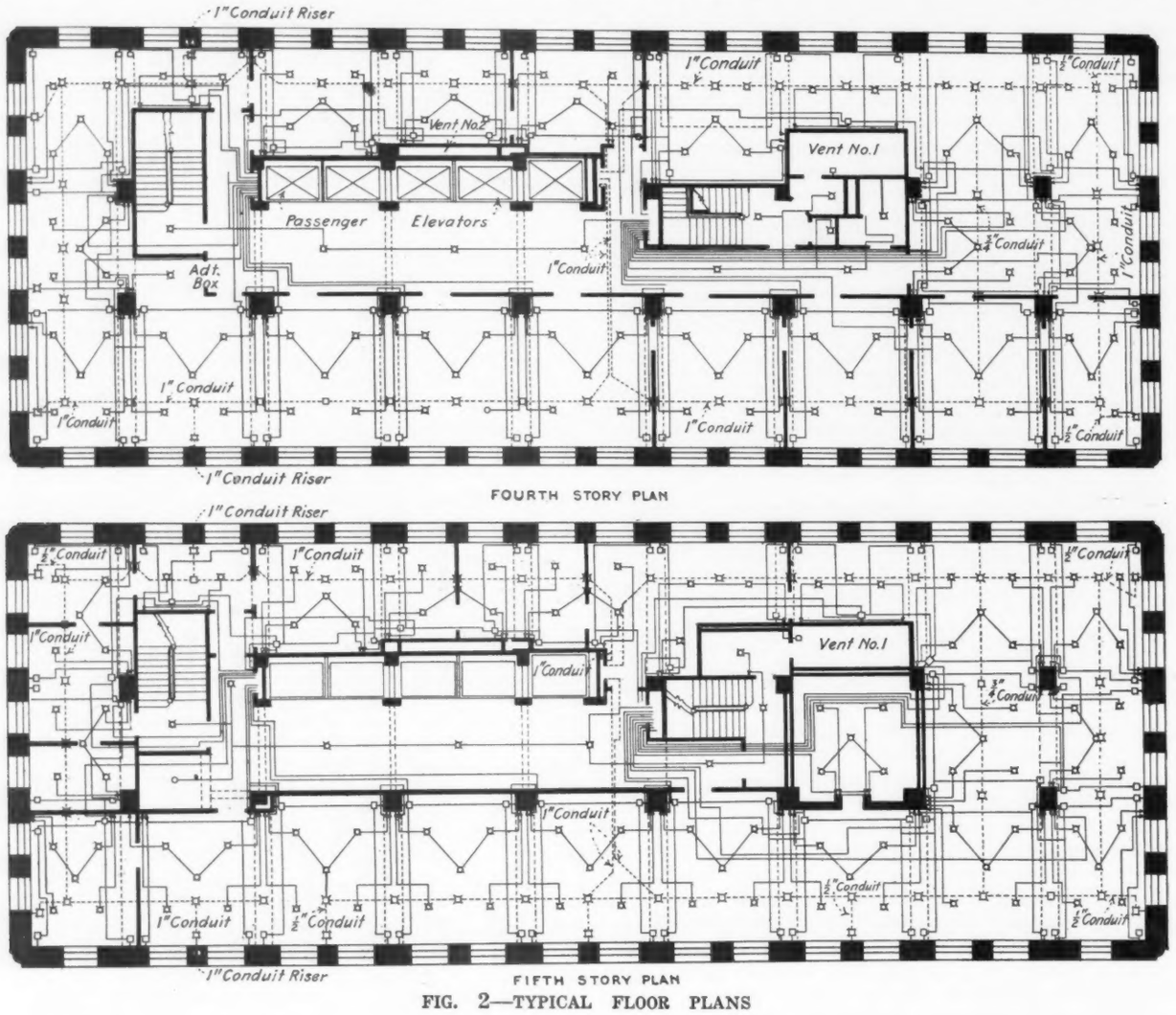


FIG. 2—TYPICAL FLOOR PLANS

building stand out against the black night in bold relief.

Arrangement of Offices and Wiring

Offices and a substation of the Cleveland Electric Illuminating Company occupy the first six floors of this fourteen-story building, while the remainder has been divided into office space for tenants. With the substation occupying a space three stories high extending from the basement to the third floor in the rear of the building, the remainder of the first-floor space is given over to offices of the contract department, and the main office, or customers' reception room. Being finished in white marble and illuminated by 100-watt lamps in indirect metal-bowl fixtures, this is perhaps the most attractive room in the building. The indirect units are hung in bays measuring 19 ft. by 16 ft.

The remaining five floors of the company's portion of the building are occupied respectively by the new-business department, the operating department, the combined drafting and billing department, general accounting and collection departments, and the executive offices. Throughout these five floors, as well as on the rentable floors, the average size of the bay is 16 ft. 9 in. by 19 ft., and in this space five ceiling outlets have been placed. With this arrangement it has been found unnecessary to install additional outlets when the bays are divided to suit the fancy of the office occupants. All ceiling lamps are controlled from push-button switches. Many favorable comments have been heard upon this wiring layout, as in the average office building additional outlets generally have to be installed to meet the special requirements of the tenants, while in this building a renter may divide his space however he chooses and still be able to secure sufficient illumination without additional wiring.

Instead of using a large red diffusing bowl, a 2-cp frosted-tip carbon lamp covered by a color hood such as is used on electric signs has been used to designate

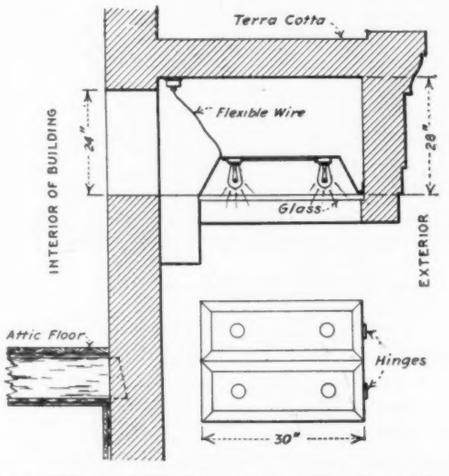


FIG. 3—SECTION THROUGH BAY USED FOR EXTERIOR LIGHTING

each exit to the fire escapes of the building. These lamps are unobtrusive and give sufficient illumination to serve their purpose.

Recent Telephone Patents

Mr. Charles Adams-Randall, Boston, Mass., has approached the solution of clear, intensified speech transmission from one direction. In a patent issued to him recently he describes an enunciator similar to the sounding box of a musical instrument, attached to one side of which are the magnetic cores and energizing coil of a watchcase receiver. The diaphragm is omitted, however, and in its place is clamped a grid of steel strings under tension.

Mr. J. G. Cory, Coffeyville, Kan., has patented a transmitter antiseptic attachment in the form of a metal collar which can be inserted between the mouthpiece and transmitter casing. The collar contains a receptacle for the disinfectant.

The antiseptic telephone attachment designed by Mr. A. C. Gaynor, Bridgeport, Conn., consists of an antiseptic-soaked fiber attached to a guard ring supported by arms several inches in front of the mouthpiece.

Another antiseptic device, the patent on which is held by Mr. T. Duquette, Sr., North Grosvenor Dale, Conn., consists of an absorbent pad supported in a hinged cap attached to the transmitter mouthpiece.

Letters to the Editor

The Determination of Glare

To the Editors of the Electrical World:

SIRS:—On account of my absence from America, Dr. P. G. Nutting's criticism, in your issue dated May 23, of my article on an instrument for glare measurement, in your issue of March 21, has only recently come to my attention.

The main considerations pointed out by Dr. Nutting are almost obvious to one who has worked in this field. I had them in mind during the development of the instrument and when I wrote the article, and I hoped—but apparently without good reason—that I had put the matter in such a way as to forestall such criticism. The question turns upon the quantitative definition of glare, or "percentage glare," as I have called it. I have defined and used this expression in the sense of the fraction of the total light entering the instrument (under the given conditions of illumination) which is specularly reflected from the paper. This is quite equivalent to the ratio of the apparent brightness caused by specularly reflected light to the apparent brightness caused by both specularly and diffusely reflected light, and this is just what Dr. Nutting himself says that I have measured.

As I see it, the only "serious error" of which Dr. Nutting has convicted me is the definition and use of a word in a somewhat different sense from that to which he is accustomed. For this I shall gladly apologize and seek another expression. But, by whatever name its operations may be called, the instrument nevertheless furnishes a convenient and accurate means of measuring the "glossiness," or "glaze," or "shininess," of paper on an arbitrary scale which is characteristic of the instrument. If it should eventually be desirable to reduce the readings to the scale suggested by Dr. Nutting, this can be readily done as he has pointed out. Personally I am inclined to doubt the desirability of such reductions, although I am quite willing to accede, if possible, to any preference Dr. Nutting or the Illuminating Engineering Society committee on glare from reflecting surfaces may have in the matter.

Rothenburg, Germany. L. R. INGERSOLL.

Resistivity on Trial

To the Editors of the Electrical World:

SIRS:—In his letter on "Resistivity on Trial," published in the June 6 issue, Mr. T. D. Waring presents a rather vigorous indictment of the term "mass resistivity," and it seems necessary that a friend of the accused should be heard in order that the unbiased public may reach a just verdict. The victim of the attack has been a valuable and proper member of the electrical community for many years. Mr. Waring's antagonism was known to us at the Bureau of Standards through recent correspondence, and we supposed that we had already by letter made sufficient rebuttal of the charges brought. In view of the public opening of the case a summary of the points at issue is herewith presented.

It is gratifying to note that Mr. Waring makes no argument against the *quantity* itself called mass resistivity, but only against the name used for that quantity. The property described by this name is such a practical convenience and is so universally employed in the wire-producing industry that there are people who are familiar with no other kind of resistivity. Its advantages and its extensive use depend on the fact that the mass of a wire is more accurately and easily determinable than the average cross-section, and on the further fact that for many engineering purposes (since conductors are sold by weight rather than by volume) the quantities directly concerned are the ohms, mass and length, rather than the ohms, cross-section and length. Of course, the same information is obtained from the volume resistivity (requiring measurement of cross-section), plus the density. The practical advantage of the mass resistivity is that it combines in one the two variables, volume resistivity and density. A quantity such as this must have a name, and the issue now under consideration is whether it is properly called "resistivity."

Questions of nomenclature may be viewed from any or all of the three standpoints—the philosophical, the utilitarian and the historical. That is, one may consider: (a) what is the essence of the reality designated by the term in question; (b) what will be the practical advantages or disadvantages if the term is given the meaning desired; (c) what is the meaning accepted for the term in past and current usage. Mr. Waring adduces arguments in all three classes, and they will be considered in this grouping.

Approaching the question of the essential meaning of "resistivity," Mr. Waring objects to a definition in terms of the resistance of a unit specimen. (In the second edition of Bureau of Standards Circular 31, Jan. 1, 1914, the statement was made: "Resistivity is definable in the most general way in terms of the resistance of a unit specimen"; in the first edition "as" was used instead of "in terms of.") He fears that resistivity is not thus sharply set off from resistance, and he then defines resistivity as "an innate property of the substance which determines the resistance." As a scientific definition, is not this rather loose? As a philosophical attempt to portray the real idea involved, it is perhaps more satisfactory, and yet we have not done much toward the definition of a property of a substance when we have declared it to be "innate."

If a precise definition is wanted, setting forth the

heart of the idea, and not too constricted on the one hand nor too vague on the other hand, we may say that resistivity is that property of a substance in virtue of which electric energy is converted into heat when an electric current flows in the substance. Quantitative experiments have furnished us with relations by which we can show how resistivity varies with quantities which are directly measurable. To be sure, the most familiar mode of expressing a numerical measure of resistivity is through the equation.

$$R = \rho \frac{l}{s} \qquad (1)$$

where ρ is the common or volume resistivity and s is the cross-section. But this relation is not more valid than

$$R = \delta \frac{l^2}{m} \qquad (2)$$

where δ is the mass resistivity and m is the mass. Certainly both δ and ρ are "innate properties" and can not therefore violate Mr. Waring's general definition. Indeed Mr. Waring admits that one is *a priori* as good as another *for linear circuits*, and even describes a third possible kind of resistivity. As the latter is nowhere used, it will not be discussed here.

The limitation to linear circuits is quite unnecessary, and the statement that the analogy between the kinds of resistivity breaks down for other forms of circuits is incorrect. The generalized defining equations of the two kinds of resistivity hold equally well for more complex conductors, and, furthermore, the simple relation between the two is unchanged. Equation (2) is true only for a uniform conductor, but it must not be forgotten that equation (1) is likewise true only for a uniform conductor. For example, if the cross-section is variable, equation (1) does not give correct results if the average cross-section be substituted in the formula. Therefore (1) is not superior to (2), and in fact the following relation holds in any case (d being density):

$$\delta = \rho d \qquad (3)$$

For the general case of conduction in a non-homogeneous lump of material (letting I = current, E = potential, and ds = differential cross-section),

$$I = -\int\int \frac{1}{\rho} \frac{\partial E}{\partial l} ds$$

We can strictly define resistivity for the element only, in the general case; throughout the elements ρ and d are constant, so we may write:

$$I = -\frac{1}{\rho} \frac{\partial E}{\partial l} s$$

Letting V = volume, since $s = \frac{\partial V}{\partial l}$

$$I = -\frac{1}{\rho} \frac{\partial E}{\partial l} \frac{\partial V}{\partial l} = -\frac{1}{\rho} \frac{\partial E}{\partial l} \frac{\partial m}{\partial l} \frac{1}{d}$$

By the definition of resistance, these equations become:

$$\rho = \frac{\partial R}{\partial l} \frac{\partial V}{\partial l} \qquad (4)$$

$$\delta = \rho d = \frac{\partial R}{\partial l} \frac{\partial m}{\partial l} \qquad (5)$$

The relation (3) thus still applies. While the equations (4) and (5) may look a little strange, they are really helpful in conceiving of the "innate" nature of either kind of resistivity. In words, they correspond to the following symmetrical quantitative definitions: Volume resistivity = product of resistance per unit length into volume per unit length, and mass resistivity = product of resistance per unit length into mass per unit length. In either case one thinks of an actual lump of the material, and surely the quantities in the second definition are not less "innate" in the material than the quantities in the first definition.

Another point regarding the conception of resistivity. By writing mass resistivity as ρd, one may be misled into discrediting mass resistivity as not being a fundamental property but the mere combination of two other quantities. But, of course, volume resistivity has no superiority in that respect, since we can write it as $\frac{\delta}{d}$. As a matter of fact, in practice the advantage of δ is that it does combine two variables in one, as stated before. Since in measuring resistivities of wires δ is commonly determined directly (as it is easier to determine the mass than the cross-section), d is needed in addition to δ in order to get ρ.

From the pragmatic standpoint, there seems little question of the desirability of the term "mass resistivity." We may ask critically: Does the existence of this expression cause considerable confusion or even errors, and if so is there a better term to substitute for it? We should answer both questions in the negative. Except in the technique of wire calculations, "resistivity" is generally an abbreviated expression for volume resistivity, and no one is led into error. Where the word is used in the more general sense, it will usually be found that either it designates simply the general "innate resistance-determining property," so that one may safely think of either kind of resistivity, or else the units are stated or known. For cases where it is desired to indicate clearly which kind of resistivity one is using, the terms "mass resistivity" and "volume resistivity" are aptly descriptive. It would be difficult to secure their advantages by other names. For instance, "resistation" bears absolutely no suggestion to the mind of what it might stand for. There will be much hesitation in accepting "resistation."

As to the third point of view, custom and usage, there can be no question of the good standing of mass resistivity. In his classical researches of fifty years ago on resistivity Matthiessen gave his results in terms of the resistance of a wire 1 m long weighing 1 gram. The American Institute of Electrical Engineers for the past twenty-one years, and the British engineering standards committee for the past fourteen years, have defined the standard resistivity of copper in the same terms. The definition given in the 1893 wire table of the American Institute is: "The data from which this table has been computed are as follows: Matthiessen's standard resistivity—Matthiessen's standard 1 meter-gram of hard-drawn copper = 0.1469 B. A. U. at 0 deg. C. Ratio of resistivity hard to soft copper, 1.0226." The American Society for Testing Materials likewise bases its copper-wire specifications on units of mass resistivity. While the copper standards recently adopted internationally by the International Electrotechnical Commission were under discussion, the Bureau of Standards received a most emphatic protest from a leading wire manufacturer because the bureau gave its sanction to putting the unit of volume resistivity before the unit of mass resistivity in the definitions.

From the various viewpoints in the light of which the question has been examined, it apears that a name is necessary for the quantity known as mass resistivity, and that the advantages of the name "mass resistivity" preponderate to such an extent that a substitute would be extremely difficult to establish. As yet no satisfactory substitute has been proposed.

J. H. DELLINGER,
Assistant Physicist, Bureau of Standards.
Washington, D. C.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A Good Place for the Fire Extinguisher

In the generating station of the Muncie (Ind.) Electric Light Company Pyrene fire extinguishers are hung from lugs on the front of the switchboard at about the height of an ordinary man's hand. When questioned about this practice, one of the engineers of the company recently said that, although the fire extinguishers somewhat detracted from the neat and clean apearance of the board, they are nevertheless in the best position possible. When there is trouble in the station, operators almost instinctively run to the switchboard and there, having disconnected the apparatus in trouble, they find the extinguisher at hand so that they can return to the source of interruption if need be prepared to meet the emergency.

Cost of Energy for Electric Steel Casting

The accompanying data from an electric steel casting plant at Easton, Pa., were given in a paper by Mr. C. A. Hansen, Schenectady, N. Y., delivered before the meeting of the American Electrochemical Society held in New York recently. The plant has normally been operated on the one-heat-per-day basis, requiring seven or eight hours to turn out a charge from a cold furnace.

The primary energy that was consumed per ton of steel in the ladle averaged 1050 kw-hr. When two or three heats were run per day the necessity of starting with a cold furnace was eliminated after the initial charge, and the subsequent heats lasted only four and one-half hours, with an energy consumption of 630 kw-hr. to 640 kw-hr. per ton. The load curve and power-factor of this furnace are better than with any other load of similar magnitude in the same shops. The following data were appended to the paper:

DATA ON EASTON PLANT

Average number of heats per week	15
Average weight per heat, lb.	4600
Average energy consumption per 2000 lb., in kw-hr.	900
Average repair costs per 2000 lb.	$2.50
Average electrode costs per 2000 lb.	$2.50
Average weight castings made, lb.	9
Percentage ratio of cleaned castings, risers, etc., to charged weight	92-95
Percentage of finished castings to charged weight, approximate	60

The furnace lining is repaired after thirty-five heats.

NOTE.—High energy cost and maintenance expense due to running very high heats.

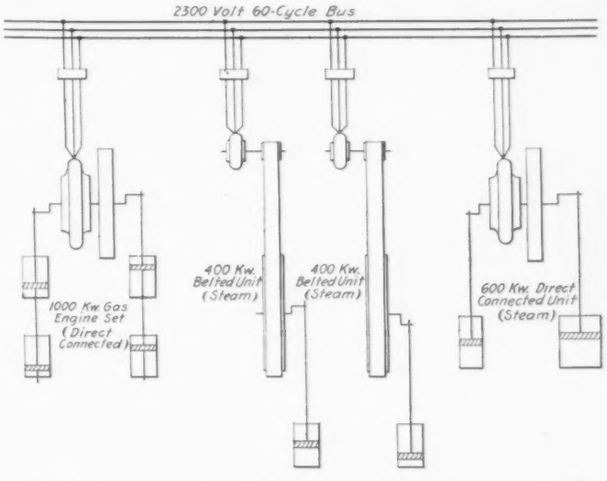
Records on the operation of a similar furnace pouring somewhat colder metal are as follows:

	Kw-hr.
Energy consumption per 2000 lb.	725
Repair costs per 2000 lb.	$1.30
Electrode costs per 2000 lb.	$2.15

The latter furnace, also operating on a fifteen-heat-per-week basis, is pouring castings of 15-lb. average weight, and repairs are made to the furnace lining about every eight to ten weeks. In the latter case the repair charges include upkeep of the bottom-pour ladles used.

Paralleling Steam and Gas-Engine Sets

The Shreveport (La.) plant of the Southwestern Gas & Electric Company contains a 1000-kw horizontal four-cylinder gas-engine-driven set, a 600-kw Corliss steam-driven set, and two 400-kw belted units. The large steam-driven and gas-engine sets are directly connected, but ever since the latter was installed it has proved impossible to operate these units in parallel under load unless one or both of the belted sets are at the same time in service across the bus. The gas-engine set can be run successfully in parallel with the steam set at half the latter's full rated load (secured by lowering the smaller unit's field excitation), but if the load on the steam set be increased beyond this point marked fluctuation of the lamps begins and grows rapidly worse as the division of load is shifted more and


2300 Volt 60-Cycle Bus
1000 Kw Gas Engine Set (Direct Connected)
400 Kw. Belted Unit (Steam)
400 Kw. Belted Unit (Steam)
600 Kw. Direct Connected Unit (Steam)

ARRANGEMENT OF GAS-ENGINE AND STEAM SETS IN SHREVEPORT PLANT

more onto the steam-driven generator. As soon as one or both of the belt-driven machines are added to the line this "pumping" ceases, the slippage of the belts apparently providing for the absorption of the exchange energy due to the angular variation of speed of the two directly connected sets. The gas-engine set runs at 100 r.p.m. and the directly connected steam unit at 120 r.p.m. Experiments have been made in varying these speeds within a range of 15 r.p.m. fast and slow, but still without practical solution of the problem of parallel operation.

Recently one side of the large gas engine was dismantled for repairs, and the other half was continued in service to drive its generator during the peak load. To the surprise of the engineers, under this unbalanced condition the gas unit paralleled nicely with the directly connected steam set, without even the assistance of the belt-connected sets.

The directly connected steam set is at present equipped with a 36-ton flywheel. This is to be replaced by a wheel of the same size as that on the gas-engine set, 24 tons, and with this change it is hoped that

straight parallel operation will be possible with the two directly connected units.

In connection with the same station it is also of interest to note that the gas-fired boilers and non-condensing steam-engine sets consume about three and one-half times as much gas per kilowatt-hour produced as does the large internal-combustion engine above referred to.

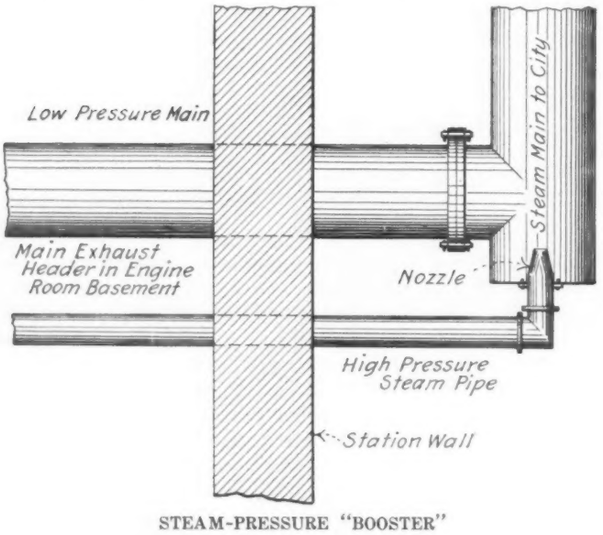
Hold-Off Card and Guard for Switches

Accidents are sometimes caused by switchboard attendants closing switches while repair or construction work is being done on the circuits they control. This is likely to occur at the beginning of a shift when the new man is unfamiliar with what has happened during the previous shift.

To guard against this condition the Wichita Falls (Tex.) Electric Company has adopted the practice of placing a wooden guard box and "hold-off" card over the switch handle so that it cannot be closed. The card has a black surface in the middle of which is a red circle. Over the circle is printed "Safety First," and underneath the circle are the words "Do not close this switch." On the opposite side of the card is the heading "Reasons," with several blank spaces which can be filled in. Similar warning cards may also be employed in tagging disconnecting or oil switches when work is being done on the circuits which they control. Such cards may also be placed in various parts of the generating station where accidents are likely to occur or where extra precaution is required.

"Booster" for Low-Pressure Steam-Heating System

Low-pressure steam for the heating system in Springfield, Ill., is supplied from the station of the Springfield Light, Heat & Power Company, situated well out of the business center of the city. On cold days when the heating load is heavy live steam has to be introduced



STEAM-PRESSURE "BOOSTER"

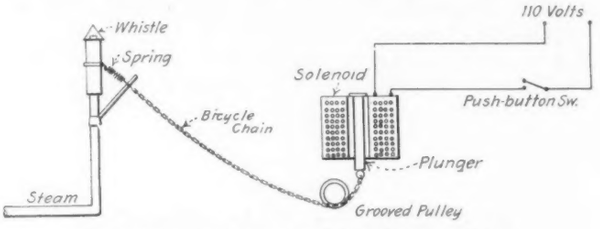
into the mains to keep the pressure at the proper point.

Under the direction of Mr. R. E. Hagenah, superintendent and chief engineer for the company, a nozzle was installed in the head of a T-joint outside the station wall where the city main starts. A 3-in. pipe leading to the nozzle is equipped with a valve so that live steam may be added when it is needed.

The effect of opening the live-steam valve can be noticed immediately on the pressure gages in the business center of the city and in the operation of the engines supplying low-pressure steam to the system. When the demand for steam is great both the heating system and the engines can be operated more efficiently with the "nozzle booster" in operation. Plans are now under way for laying several pipes of different sizes so that the live-steam flow may be controlled more accurately according to the needs of the heating system.

Solenoid-Operated Engine-Room Whistle

Nearly every generating station of any size is equipped with some sort of signal for informing employees when engines are to be placed in operation or are to be stopped. The solenoid-operated whistle shown in the accompanying sketch was installed in the plant of the Springfield (Ill.) Light, Heat & Power Company to save time and labor for the man in charge at the operat-



SOLENOID-OPERATED ENGINE-ROOM SIGNAL

ing desk and has amply paid for the effort required to devise and erect it.

As will be seen from the drawing, the circuit controlling the actuating solenoid is carried from its 110-volt supply terminals through a push-button switch near the engineer's desk and thence to the solenoid in a distant part of the room. Closing the switch at the desk energizes the coils of the solenoid, creating an upward pull on the iron core of the plunger. This force, transmitted through a discarded piece of bicycle chain, opens the valve in the steam line beneath the whistle. A spring returns the whistle lever to its normal position when the electric circuit is broken at the push-button.

Making Permanent Steel Magnets

How can I magnetize steel bars or files so that they can be used to lift screws out of holes? I have magnetized several bars of this kind on the poles of an electroplating generator carrying 800 amp, but the bars did not remain magnetized. J. C. G.

A simple method of magnetizing steel bars which is used in the factory of a magneto concern is to wrap a few turns of lamp cord or ordinary No. 14 wire around the bar to be magnetized. The low-resistance coil thus formed is then connected in series with a 30-amp or 40-amp fuse and the switch closed to a 110-volt direct-current source of supply. The resulting sudden heavy rush of current will thoroughly magnetize the bar and also blow the fuse before any damage can result from the large short-circuit current. The use of the fuse secures a large magnetizing current for a brief interval, and bars of good steel magnetized in this way should hold their magnetism permanently. Jarring, vibrating and rough handling will, of course, cause a permanent magnet to lose its magnetization, and when such a magnet is not in use it should be provided with a soft-iron "keeper" to afford a return path for the flux between its poles. The short-circuit method above described should not be used, of course, on a circuit of small cross-section where damage might result from the momentary heavy current flow.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Low-Hysteresis Silicon Steel.—A note on a recent British patent (No. 11,370, 1913) of the British Thomson-Houston Company and the General Electric Company of this country for the manufacture of silicon steel having a very low hysteresis coefficient. Silicon-steel sheets are assembled in packs and placed between graphite heaters in an electric furnace. The latter is then connected to an evacuator, and the internal pressure is reduced to a pressure equal to 2 mm of mercury while the temperature is raised to about 1325 deg. C. All the oxides present in the silicon steel are thus reduced. The duration of the heating process depends upon the amount of steel to be treated. Whereas a charge of 500 lb. requires a run of five hours, 100 lb. can be treated in about two hours. The resulting product has a peculiarly large granular structure, and low hysteresis-factor.—London *Elec. Eng'ing*, June 11, 1914.

Three-Phase Generators in Parallel.—FRANKLIN PUNGA.—A mathematical article in which the author calculates and determines experimentally the critical value of the moment of inertia for three-phase generators of equal capacity and number of revolutions but driven by different prime movers. A simple formula for the calculation of the frequency of oscillations of alternators of different design is also given.—*Elek. Zeit.*, June 11, 1914

Lamps and Lighting

"Marble Light."—W. VOEGE.—A translation in abstract of his German article abstracted some time ago in the Digest on the use of marble as a medium for the distribution of light. Marble plates are ground on both sides and then impregnated with various oils at high pressures and temperatures.—London *Electrician*, May 29, 1914.

Electric and Gas Lighting.—E. RONZANI.—A paper on the relative hygienic effects of electric and incandescent gas lighting. The author discusses the chemical and physical changes in the surrounding air, the purification of the air, ventilation, and the relative effects of gas and electric lighting on animals.—Abstracted from *Annali d'Igiene Sperimentale*, Vol. XXIII, No. 3, 1913, in London *Electrician*, May 29, 1914.

Lighthouse.—M. WOLF.—An illustrated description of recent progress in lighting appliances for lighthouses.—*Zeit. f. Beleucht.*, May 10, 20 and 30, 1914.

Generation, Transmission and Distribution

Norwegian Water-Powers.—NORBERG SCHULZ.—The author gives tables and diagrams of the fluctuations of the volume of water available in Norwegian water-powers and discusses the calculation of the capacity of steam-reserve power plants to be operated in connection with the water-power plants.—*Elek. Zeit.*, June 4, 1914.

Installations, Systems and Appliances

Improving the Power-Factor.—An article illustrated by diagrams in which the effect of wattless current is first discussed. In a system having 70 per cent power-factor little may be gained by removing entirely the wattless component of the load; it is sufficient to reduce the wattless load to one-third. For instance, if the useful load is 1000 kw, the total resultant load is 1400 kw, and if the wattless load is reduced to one-third the resultant load is reduced to 1055 kw. The various advantages of improving the power-factor are discussed. A description is given of the installation of a large synchronous condenser in one of the substations of the Sheffield municipal system, and it is then pointed out that where the conditions are such as to render a synchronous motor undesirable, or an induction motor is already installed, the British Thomson-Houston phase advancer offers great advantages. This is described and discussed at some length.—London *Electrician*, May 22, 1914.

Power-Factors of Alternating-Current Circuits.—G. M. BROWN AND N. SHUTTLEWORTH.—A discussion of the power-factor problem from the standpoint of the central-station manager. Formerly the question of power-factor was no problem because the loads were chiefly lighting or railway. However, the past ten years has seen a rapid industrial development. For all classes of this work the induction motor has taken the lead until now on many systems the induction motor load is larger than the lighting load. The authors deal with English practice in particular. In America both the synchronous condenser and the phase advancer are in successful use.—*Gen. Elec. Rev.*, May, 1914.

By-Products of Gas Power Plants.—H. R. TRENKLER.—The author investigates whether the high thermal efficiency of gas engines permits their more general use in central stations. He concludes that the efficiency of the gas producer and the cost of operation of the whole gas plant are also to be taken into account and that for this reason gas engines become economical in ordinary central stations only for exceptionally low cost of fuel. The situation becomes different if the production of by-products is taken into account, as for instance in Mond gas plants. The results are given in a table for different fuels. The author discusses especially the use of lignite and peat, and calculates the cost of gas obtained from peat. His calculation shows a very considerable reduction of the cost of gas and electricity due to the manufacture of by-products.—*Elek. Zeit.*, June 11, 1914.

By-Products of Central Stations.—HAROLD GRAY.—The author recommends the use of gas engines for central stations and emphasizes that the recovery of by-products, and particularly of sulphate of ammonium, is worth considering. For the present he recommends the combination of gas engines with steam turbines. The gas engine must do extremely arduous work, viz., run twenty-four hours per day six days a week, in order to show a substantial gain over the turbine. That is to say, the gas-engine plant should not be required—and, in fact, must not be used—to take the extremely irregular load common in the winter months on an ordinary electrical system. It can deal with the twenty-four-hour load more efficiently than any other prime mover. The rest of the load, which is of an irregular character, should be taken by steam turbines until the big gas

turbine has become a realty. The author points out that one of the most important considerations to-day in a power-station is the provision of sufficient clean water, and that a gas-engine plant requires less than 20 per cent of the water at a given temperature required for a steam plant. This consideration is one which is becoming of increasing importance.—London *Electrician*, June 12, 1914.

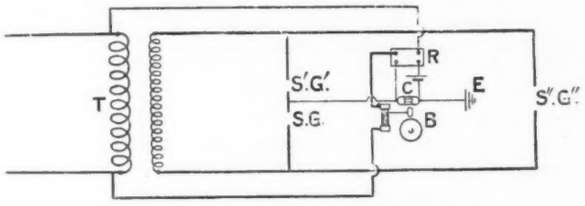
Electrophysics and Magnetism

Wave-Length of the Soft Gamma Rays from Radium B.—Sir Ernest Rutherford and E. N. da C. Andrade.—An account of an experimental investigation, the chief results of which are as follows: The gamma-ray spectrum of the soft radiations from radium B has been examined by reflection from the cleavage faces of crystals and found to consist of a number of well-marked lines. The gamma-ray spectrum of radium B is found to be of the same general type as that found for platinum and other heavy elements when bombarded by cathode rays. Attention is directed to the structure of the spectral lines using an emanation tube as the source of radiation, and also to the imperfections of the crystals employed. Evidence is given indicating that the spectrum of the soft gamma rays spontaneously emitted from radium B is identical within the limits of experimental error with the spectrum given by lead when the "L" characteristic radiation is excited by the bombardments of beta rays. The bearing of these results on the structure of the atom is discussed.—*Philos. Mag.*, May, 1914.

Photoelectricity.—Herbert E. Ives.—A brief note on an American Physical Society paper on the relation between illumination and photoelectric current in potassium cells. Voltage-current and illumination-current curves were taken for one particular cell at four stages. The voltage-current curves show various stages between one extremely convex to the voltage axis and one extremely concave thereto. The illumination-current curves correspondingly change from being convex to the illumination axis to being concave thereto. The author's results confirm his former conclusion that the photoelectric current is not as yet proved to be a linear function of illumination.—*Physical Review*, May, 1914.

Reflection of Roentgen Rays on Crystals.—W. H. Bragg.—An account is given of experiments in which the intensities of reflected X-ray pencils of various orders are compared with each other, and the results are considered in reference to the recent theoretical discussion by Debije. It appears that there is a striking agreement between theory and experiment in the case of rock salt. The difficulties of experiments with the diamond are also discussed. The existence of an X-ray absorption band in the diamond is demonstrated. The experiments give opportunity for an accurate determination of the wave-length of the rhodium X-rays.—*Philos. Mag.*, May, 1914.

Smoke Monitor.—W. W. Strong.—The smoke fume monitor and recorder is a new instrument for indicating and recording when the density of the fumes or smoke emitted by a furnace exceeds a certain predetermined density. Many furnaces are situated in places so that the top of the smokestack is invisible to the fireman. The arrangement of the new instrument is shown in the cut. *T* represents a small step-up transformer of from 75 watts to 150 watts rating. In practice the transformer operates on a 110-volt alternating current, sixty-cycle circuit, stepping up to about 26,000 volts. The high-tension side is connected to two sets of spark-gaps, which are placed in parallel, *S″G″* being placed in the smokestack and *SG*, *S′G′* being placed under standard conditions. Under normal conditions the gases coming from the incandescent fuel bed are intensely ionized, the ions consisting largely of electrons (near the fire bed if this is sufficiently hot) and thermions of molecular size. This results in the resistance of *S″G″* being relatively low, so that the discharge takes place at this gap, and consists of a quiet arc-like brush. When dust or fumes are present in these gases the ions combine readily with the suspended solid and liquid particles. For this reason the resistance of *S″G″* is increased, so that when the density of the smoke or fume particles exceeds a certain value (depending on the setting of *S″G″*, *S′G′* and *SG*) the discharge is driven to *SG* and *S′G′*, and under these conditions it is oscillatory. The remainder of the apparatus is essentially the same as that used in wireless telegraphy a few years ago. The oscillatory discharge is represented as taking place at *SG* and *S′G′* to an electrode grounded through the coherer. The smokestack, if made of iron, may be used as an antenna. The coherer operates the relay *R* through a small dry battery. The relay operates an alternating-current bell, *B*, and any other signaling device which can be controlled by an electric circuit. These devices may even include dampers, fans, steam jets, various parts of mechanical stokers, etc.—London *Electrician*, June 5, 1914.



ARRANGEMENT OF SMOKE MONITOR

Zero Method of Testing Vibration Galvanometers.—S. Butterworth.—A brief note on a (British) Physical Society paper. The methods usually employed in the determination of the constants of a vibration galvanometer involve measurements of a deflection under three different conditions. Two of these deflections can be obtained only very approximately. By extending the theory of the vibration galvanometer it is shown how the constants may be determined by methods which involve only the measurement of one deflection. The remaining measurements are carried out on an alternating-current bridge, and the results obtained are practically independent of the wave-form of the source. The principle of the method depends on the fact that a vibration galvanometer behaves as a parallel combination of a conductance, a capacity and an inductance, in series with a resistance.—London *Electrician*, June 5, 1914.

Cold-End Compensator for Thermocouples.—Charles B. Thwing.—A brief note on an American Physical Society paper. The method of compensating for variations in the temperature of the cold ends of a thermocouple used in connection with a direct-reading indicator or recorder consists in placing in series with the couple at the cold end a Wheatstone bridge of low resistance. Three arms of the bridge are of manganin, the fourth being of nickel. The current through the bridge is so adjusted by resistance in the battery circuit as to give direct readings of temperature at the bridge when the thermocouple is not in circuit. When couple and bridge are connected in series the readings of bridge and thermocouple are combined to give true temperature readings. Otherwise expressed, the bridge automatically sets the zero of the indicator to cold-end temperature.—*Phys. Review*, June, 1914.

Telegraphy, Telephony and Signals

German Long-Distance Telephone Cable.—F. BREISIG.—After a discussion of the advantages of a long-distance telephone cable over an overhead bare line, the author gives a greatly simplified theory of the Pupin system of loading telephone lines with inductances and explains the principles by which a Pupin line can be calculated. He then discusses the requirements of the new telephone cable connecting Berlin with the Rhine province and gives the results which were obtained in the official tests of the completed partial line from Berlin to Magdeburg. In conclusion the author presents a comparison of this new German cable with other known cables, especially the large ones in the United States.—*Elek. Zeit.*, June 4 and 11, 1914.

Miscellaneous

German Association of Electrical Engineers.—ZEHME.—The twenty-second annual meeting of the German Association of Electrical Engineers was held in Magdeburg from May 25 to 28. The board of directors adopted unanimously the new draft of regulations for the equipment and operation of "heavy-current" electric installations, to be placed in force beginning with July 1, 1915. A memorial tablet in honor of Werner Siemens was unveiled. The attendance at the reception on the first evening was 800. In the first general meeting President W. Christiani gave a review of the developments of electrical engineering during the past year. Prof. F. Foerster presented a paper on the applications of electrochemistry in the chemical and metallurgical industries. In the business meeting which followed Geheimrat E. Rathenau was made an honorary member of the association. The secretary, G. Dettmar, presented the business report for last year, according to which the association has more than 6000 members and assets of $57,250. In the second general meeting Professor Diesselhorst read a paper on progress in wireless telegraphy, Dr. Guggenheim a paper on electric steel, Prof. E. Josse and Professor Klingenberg papers on modern condensation plant. The city of Magdeburg gave a lawn party in the Herrenkrug in the evening. In the third general meeting O. Krell read a paper on electricity on shipboard. Various visits and excursions were made. Professor Klingenberg is the new president. The next annual meeting will be held in Strassburg.—*Elek. Zeit.*, June 11, 1914.

British Municipal Electrical Association at Birmingham.—The nineteenth annual convention of the (British) Incorporated Municipal Electrical Association will be held in Birmingham, with additional meetings in Coventry and Stratford-on-Avon and visits to Worcester, Rugby and Malvern. Reviews are to be given of municipal and private electrical developments in Birmingham. The municipal electricity department has now two generating stations. The Water Street station generates three-wire direct current for the supply of the immediate district, while at Summer Lane three-wire energy is also generated for the use of lighting and motor customers in the immediate neighborhood of that station; continuous current at 500 volts is, moreover, generated for traction purposes, while three-phase alternating current is generated at 5000 volts and a frequency of twenty-five cycles for transmission to a number of substations in the outlying parts of the area. The two generating stations are connected together by a number of trunk feeders. Notes are added on the Witton Works of the (British) General Electrical Company and of the Bellis & Morcom Engine Works, also on electrical engineering progress at Coventry and Rugby, and an interesting historic water-power station at Worcester.—London *Electrician*, June 12, 1914.

Psychology.—DUECK.—A discussion of some psychological problems which are of importance in the selection of men for electrical engineering work, with reference to psychological tests.—*Elek. Zeit.*, June 4, 1914.

Book Reviews

ELECTRIC ARC PHENOMENA. By Ewald Rasch. Translated from the German by K. Tornberg. New York: D. Van Nostrand Company. Illustrated. Price, $2.

This book contains a large amount of excellent information concerning the physics of arc phenomena to which the author, by his endeavor to express it in mathematical terms, has given a rather formidable appearance. The subject is viewed from the standpoint of the research and mathematical physicist and, while adapted to use of the engineer, will not attract the general reader. One chapter is devoted to the carbon arc and the external phenomena connected with it. In another are brought together many data of unquestionable value concerning electrode materials and their characteristics, particular stress being placed upon the alkaline earths, which are, at ordinary temperature, non-conducting. In the two chapters devoted to electrical discharges through gases the author discusses the concordance of break-down voltages in a sphere spark-gap and those calculated according to laws expressing the latest hypothesis in electronic theory. These chapters should be of the greatest value to those interested in research of this character. A portion of the book is devoted to an analysis of the current, voltage and power relations in the arc, and the causes and conditions of hissing and stability, couched largely in mathematical terms. A chapter on the underlying causes of arc efficiency and inefficiency concludes the book.

CONTINUOUS AND ALTERNATING CURRENT MACHINERY. By Prof. J. H. Morecroft. New York: John Wiley & Sons, Inc. 466 pages, 288 illus. Price, $1.75.

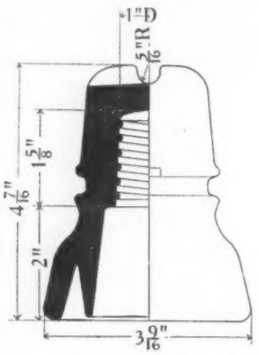
As an elementary textbook for use in technical high schools and similar institutions this book has many excellent features. The matter is well arranged, the explanations are clear, and the illustrations are good. The photographs have been carefully selected, and the line drawings fulfil their purpose admirably. Professor Morecroft has clearly realized the advantage of presenting and explaining his subject without introducing mathematical proofs except where no other method suggests itself, and the equations used are of so elementary a nature that they should present no difficulties to the class of reader for which the book is intended. The subjects covered include elementary principles of continuous currents, descriptions of dynamo machines, theory and calculation of continuous-current generators and motors, elementary principles of alternating currents, alternating-current generators and synchronous motors, transformers, induction motors, commutating alternating-current motors, and the synchronous converter. There are also short chapters treating of power in polyphase circuits, switchboard apparatus, and notes on the operation and care of electrical machinery. The diagrams on pages 296 and 302 showing leakage-flux paths in transformers are exceptionally good; they give the student a correct idea of the manner in which magnetic leakage causes loss of pressure. These will be far more readily understood by the student than the reference on page 214 to the coefficient of self-induction of a coil. This is always a difficult subject, and rather more space might perhaps have been given to an explanation of the physical meaning of reactance in alternating-current circuits.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Glass Insulator

The glass insulator shown in the accompanying illustration, which is being placed on the market by the Brookfield Glass Company, 2 Rector Street, New York, was first designed for the Pacific States Telephone & Telegraph Company's mountain lines. Two right-angled



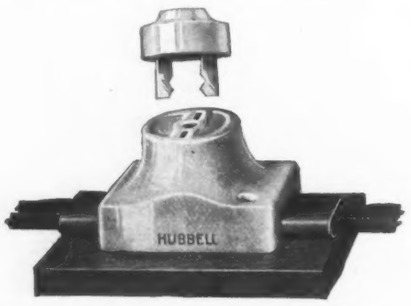
GLASS INSULATOR

grooves are provided on the top of the insulator. In the groove parallel to the line the line wire is placed. A fastening wire is passed over this wire in the other groove and is tied around the insulator in the groove provided below.

This insulator by reason of its design is especially well adapted for use on lines which are installed in hilly districts of the country.

Plug Receptacle

The plug receptacle shown herewith is designed for use with metal molding. Two styles of this receptacle are being made—one for the end of a circuit and known as a terminal-base receptacle, and the other for at-



PLUG RECEPTACLE DESIGNED FOR USE WITH METAL MOLDING

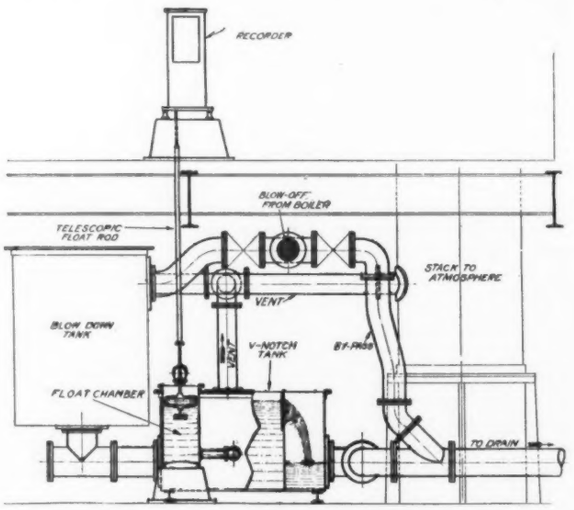
taching to the molding at any desired point and known as the two-way-base receptacle. Contacts are made for either 10-amp or 20-amp circuits, the latter being of the polarized type.

This receptacle is being manufactured by Harvey Hubbell, Inc., Bridgeport, Conn.

V-Notch Water-Flow Meter

In determining the amount of water evaporated by a boiler it is necessary to measure not only the boiler-feed input but also the intermittent blow-off discharge and leakage. The amount of water discharged through the blow-off valve and that leaking from the valve may be measured by means of a V-notch recording meter. In the accompanying illustration is a diagram showing how such V-notch meters are installed in the 201st Street station of the United Electric Light & Power Company, New York, and the Waterside station of the New York Edison Company.

This meter consists of a closed tank into which the water to be measured flows; the water passes out of the tank through a V-notch. The head of water on the V-notch is measured by means of a float which is in a separate chamber where it is unaffected by disturbing



V-NOTCH RECORDING LIQUID METER FOR MEASURING BLOW-OFF DISCHARGE

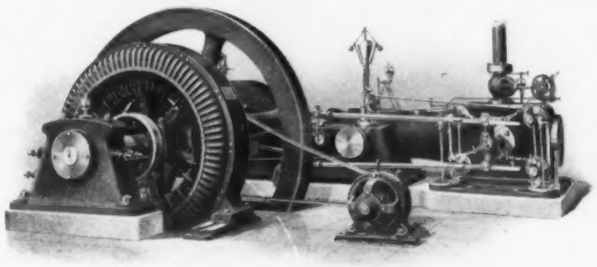
currents. A spindle attached to the float passes through a stuffing box in the upper part of the tank and through the bottom of the case which contains the recording apparatus. A rack is cut upon the spindle, which gears into a small pinion on the axis of a drum in the instrument box. A groove is cut spirally along the surface of this drum so that as a pin which fits in it is made to move forward or backward its movement corresponds to the rate at which water flows through the notch.

The pin is connected to a slider bar that is supported on pivoted rollers. A pencil point or pen, which is in contact with a paper chart, is also attached to this slider bar. This chart is mounted on a clock-driven drum, which revolves once in twenty-four hours. The chart will give, it is claimed, the exact flow of water through the tank.

The so-called Lea V-notch meter described above is being made by the Yarnall-Waring Company, Chestnut Hill, Philadelphia, Pa.

Alternator Operated by Corliss Engine

In the illustration herewith is shown a 150-r.p.m. Corliss engine directly connected to a Westinghouse alternating-current generator. The engine is equipped with four rotating valves, dash-pots, releasing gear and fly-ball governor. The stator of the alternator consists

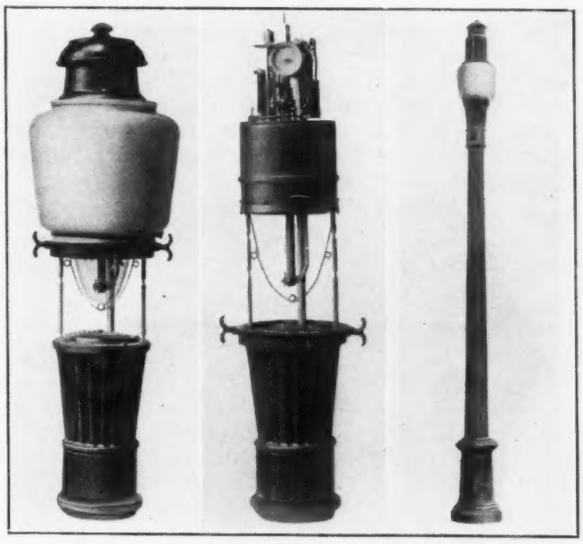


CORLISS ENGINE DIRECT-CONNECTED TO ALTERNATOR

of an iron casting into which soft-steel punchings are dovetailed. Form-wound, mica-insulated, interchangeable armature coils are held in open slots in the punchings by means of hard-fiber wedges. The alternator is designed to generate sixty-cycle, three-phase energy, and is built in sizes rated at 50 kva, 75 kva and 100 kva. The exciters used for these units are rated at 4.5 kw, 6 kw and 7 kw respectively. The Corliss engines for the above sets are manufactured by the Murray Iron Works Company, Burlington, Ia.

Flame-Carbon Lamp for Street Lighting

An arc lamp of the flame-carbon type for ornamental street lighting is being placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. A feature of this new lamp is its adaptability to practically all standard commercial circuits, since the lamps are available for operation on sixty-cycle alternating-current 10-amp, 7.5-amp or 6.6-amp series circuits, 110-volt alternating-current multiple circuits and 110-volt direct-current multiple circuits.



FIGS. 1, 2 AND 3—ORNAMENTAL FLAME-CARBON LAMP

Either white or yellow light can be produced, depending upon the carbons used. The standard glassware consists of an Alba outer globe and a clear inner globe. The globe is so designed that, while most of the light is thrown downward where it is needed, enough is thrown upward to illuminate the fronts of buildings to a considerable height. This produces an agreeable effect in the lighting of "white ways." The mechanism is in an upright position above the globe and is held firmly by three small upright rods. Because of the diffusing glassware used, these rods, it is claimed, do not throw any shadows on the surrounding buildings or street. The outer globe can be readily raised and locked in that position, to facilitate trimming the lamp and cleaning the globes.

This lamp is adaptable for use on a large number of ornamental standards and brackets now being made by various manufacturers. While commonly mounted at a height of 14.5 ft. above the pavement, a somewhat better distribution and one more free from glare is obtained by means of mounting the lamp at a height of 18 ft. above the pavement.

High-Voltage Outdoor Oil Switches

The oil switches illustrated herewith are built in single-pole elements and are designed for hand, solenoid or air operation. The mechanism for each element is self-contained and is mounted on the top of a steel tank. The switches trip free from the operating mechanism, so that the contacts cannot be held closed on overload or short-circuits.

The insulating bushings are inserted through the cover at an angle and converge at the lower end, extending below the oil level down to the stationary contacts of the switch. The contacts are of the "sliding-wedge" type, two contacts in series being provided for each phase. The stationary contact consists of flared fingers and long arcing tips of drop-forged copper. The movable element of the contact is a wedge-shaped copper blade. This blade moves in a vertical plane, being drawn up by the switch mechanism when the switch is closed and dropped by gravity assisted by springs when the switch opens. By the use of the sliding-wedge contact, the arcing set up by opening the switch under load occurs between the extended portion of the stationary contact fingers and the upper extremity of the movable blade, which sections are not in contact when the switch is fully closed.

HAND-OPERATED 22,000-VOLT OIL SWITCH

These switches have been developed by the General Electric Company, Schenectady, N. Y., and are designed for utilization with pressures of 22,000 volts and upward.

Electrically Heated Incubator and Hover

From the central-station point of view the character of load derived from operating electrically heated incubators and hovers is ideal. About twenty-one days are required to hatch chicks, and of course during that time the incubator must be in continuous operation. After the chicks are hatched it is necessary to keep them in continuously heated hovers for a number of weeks.

The case of the electric incubator shown in Fig. 2 is built of 2-in. cork board; it is reinforced with steel corners and the top is entirely covered with steel. The base, on which the egg tray stands, is made of well-seasoned cypress covered with a thick felt pad. The egg tray is of galvanized steel and has a removable wire mat on which the eggs repose. A hole in the center allows the chicks when hatched to fall into a wire basket hung on runners under the egg tray. This chick basket can be removed from the machine by raising the cover to the first notch on the trigger provided; in the event of a straggling hatch the operator can therefore remove the chicks without exposing the still unhatched eggs. The heavy felt pad covers a base that has small slits in it. Air is filtered through this pad. A ventilating tube extending through the roof and attached to the cover leads down through the hole in the egg tray into the nursery chamber. The amount of air is varied by means of a sliding cap on the tube.

The front of the case is provided with a small glass window to show the interior and allow the thermometer to be read. The heating units are contained in the roof and slip into spring clips, making them interchangeable and removable. These units are of the cartridge type and are so arranged that the heat is equally distributed over all parts of the egg tray. The supply of heat is automatically controlled by means of a thermostat. A signal lamp indicates when the heating circuit has been opened.

In Fig. 1 is shown an electrically heated hover. An automatic heating system similar to that used in the incubator described above is employed. The top of this hover is made of 2-in. cork board which is covered with sheet steel. The curtains are double and of heavy canvas duck provided with a layer of 0.5-in. felt in between and above the slits. The heating coils are placed just under the roof and are protected from injury by a heavy wire screen.

FIG. 1—CHICK HOVER

The electrically operated incubator and hover described above are being placed on the market by the United Electric Manufacturing Company, New Orleans, La., which builds incubators in sizes to contain 24, 40, 70, 120, 250 and 500 eggs and hovers to accommodate 15, 30, 50, 75 and 200 chicks.

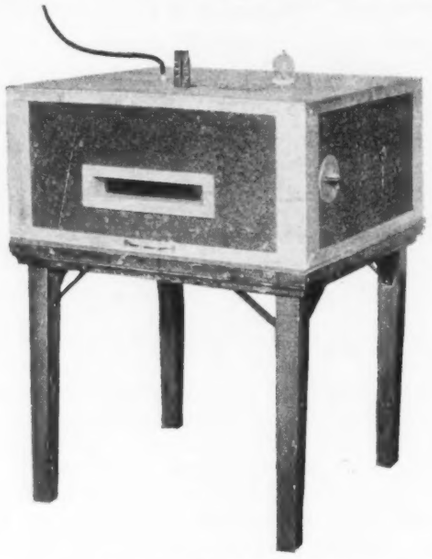
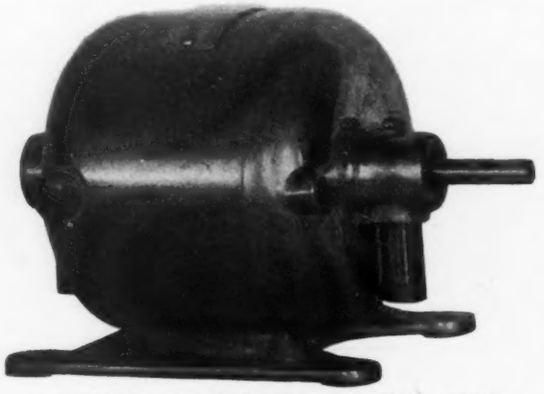


FIG. 2—EGG "STANDARD"

Small Inclosed Motor

The motor shown in the accompanying illustration is equipped with a one-piece die-cast shell and detachable end covers which are also die-cast. Metal-screw brush-holder caps, all-metal oil cups inserted beneath the bearing, and substantial die-cast feet extending beyond the length of the body, but well within the over-all reach of the bearing housings, add to the general stability of the machine. The frame is without angles or projections and has all the "fit-in" qualities demanded of small motors. The field frames are composed of laminations. This small motor is for general power usage and may be equipped with or without feet as desired.



FRACTIONAL-HORSE-POWER INCLOSED MOTOR

It is rated at 1/20 hp when operating at 2500 r.p.m. on direct current and at 1/30 hp when operating at 2500 r.p.m. on alternating current. This motor is being made by the Diehl Manufacturing Company, Elizabeth, N. J.

Ozone Air-Purifying Apparatus

The ozone air purifier illustrated herewith is equipped with a rotary converter for transforming direct current to alternating current and a transformer which steps the voltage up to the high pressures required in this service. An electric fan is mounted within the transformer case to blow the ozone out into the room. To eliminate the production of metallic oxides due to the ozone coming in contact with the metals of the outfit, all wiring is hermetically sealed in glass tubes. The design is also such as to prevent any heating, thereby avoiding the production of nitrous oxides.

APPARATUS FOR PURIFYING AIR BY OZONE

This machine is being used successfully in moving-picture theaters. It is also widely utilized in the refrigerators of abattoirs and meat markets where it is claimed that a saving in ice is made as well as an improvement in the refrigeration. It is stated for example that fish can be kept three times as long with this system as when ice alone is used, and the odors are practically eliminated. This machine is being placed on the market by the Neel-Armstrong Company, Akron, Ohio. The fan and the rotary converter used with it are the product of the Robbins & Myers Company, Springfield, Ohio.

A General Alarm for Telephone Systems

In manufacturing plants, public buildings, schools and other institutions which have private telephone systems there is frequently need for a device which will ring a number of bells or buzzers simultaneously. Such a device is being placed on the market by the Western Electric Company, New York, for use with so-called general-alarm or code-signaling sets.

SIGNALING SET

These sets are designed to call to the nearest telephone any one of a number of men by an arbitrary selective code, to sound an alarm in case of fire or other emergency, or to sound bells for recess or recitation periods. The sets may be used independently of the telephone systems. The signaling set can be mounted at any central point and bells and buzzers scattered wherever signals are to be given. A turn of a key handle will sound a call simultaneously on all the bells and repeat the call four times, each key sending out a different code signal.

The signal sets described are connected to the telephone or inter-telephone system together with an auxiliary resistance and condenser box. These sets are made in any size that may be desired, ranging from two up to ten different signals.

Electric Vaporizer Designed for Gasoline Engines

An electric vaporizer, which will facilitate the starting of gasoline engines in cold weather, has been added to the growing list of electrical accessories for gasoline vehicles. Heretofore in cold weather it has generally been necessary to "strangle" the intake air to the carburetor before a gas mixture rich enough to explode when ignited could be obtained. If the carburetor intake was not provided with a throttling device, the engine usually had to be cranked several times before it would start. Equipped with this new electrical device, however, the engine will start as readily in cold weather as on a warm day.

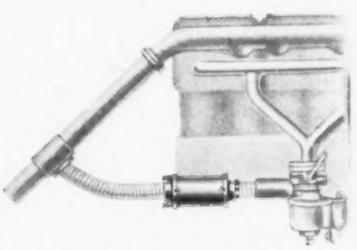


FIG. 1—ELECTRIC HEATER FOR GAS INTAKE ON LARGE ENGINE

FIG. 2—GAS MANIFOLD HEATER FOR SMALL ENGINE

The accompanying illustrations show two forms of vaporizers, one applicable to small engines and the other to higher-powered engines. The first consists of a hollow spiral of resistance wire connected between two insulated terminals in the intake manifold. The device for the larger engines is more elaborate, consisting of a cylindrical case in which are three asbestos disks with resistance coils wound around their peripheries. These coils are supported on a single spindle and are connected in series between two insulated terminals passing through the cylindrical case of the vaporizer. The vaporizer is interposed between the carburetor and the air intake which may surround the exhaust pipe. With this arrangement 6 volts need be applied across the terminals of the vaporizers only to start the engine, after which the intake air is heated by passing around the exhaust pipe.

This device, it is asserted, makes electric cranking more practicable, as the engine starts more quickly, thereby reducing the period of high-current demand on the storage battery. As a result a smaller battery can be used for starting and the troubles attending high rates of discharge are diminished.

Both forms of electric vaporizer described herewith are handled by the H. W. Johns-Manville Company, New York.

Jobber, Dealer and Contractor

Missouri Contractors' Association

The Electrical Contractors' Association of Missouri will hold its annual meeting in St. Louis on July 11, 1914. Mr. A. J. Burns, 318 West Kent Street, Kansas City, Mo., is secretary of the association.

Contractors at Detroit

Final arrangements have been made for the annual convention of the National Electrical Contractors' Association in Detroit, July 15 to 18. Both as an educative force and from the viewpoint of entertainments, it is believed that the convention will break all records among electrical contractors. Rather elaborate decorative effects have been worked out, and Mr. Ernest McCleary, as chairman of the convention, is putting forth every effort in directing the final details to have this convention one long to be remembered. For July 17, which is the thirteenth birthday of the association, an enjoyable program has been arranged. The steamer *Pleasure* has been chartered for an outing, and all in attendance will be taken 15 miles down the river to the island park "Bob-Lo." Special entertainers have been engaged for the boat trip. A large attendance is anticipated.

Oregon Electrical Contractors

At the second annual meeting of the Oregon Electrical Contractors' Association, held at Portland, June 8 and 9, President R. G. Littler referred to the importance of the campaign for a state license law for electrical contractors. He stated that some irresponsible contractors preyed upon the public by collecting money for work never completed. He held that a state license law would guarantee that first-class work would be done and would increase the desirability of credit risks which jobbers have to carry. Mr. F. C. Green, secretary of the association, submitted the proposition of amalgamating the State Association of Contractors and the Portland Electrical Contractors' Association, and a committee was appointed to prepare a report on the matter. Mr. J. R. Tomlinson, who was elected director, will represent the association at the convention of the national body in July, at Detroit. Election of officers was postponed because of the proposed consolidation of the state and city contractors' associations.

Contractors Enlisted in Iron Campaign

The United Electric Light & Power Company, New York, has been conducting a sixty-day flatiron campaign in which it has enlisted the services of electrical contractors to sell 2500 three-and-one-half-dollar irons at $2.49. To excite widespread interest in the campaign, illustrated pamphlets were distributed describing the comforts and conveniences of ironing with electricity. Each picture suggests the ease of operation.

Window display cards were furnished the contractors to inform the public that they were agents of the electric-service company in this campaign. These agents have also been stocked with irons which they are permitted to sell at the reduced price and retain a 10 per cent commission thereon. The campaign has created considerable interest, more than 1100 irons having been disposed of in one district during the first three weeks of the special sale.

Closer Co-operation in Chicago

During a recent visit to Chicago Mr. G. B. Muldaur, field representative of the Society for Electrical Development, Inc., began the formulation of plans for the closer co-operation of central stations and electrical jobbing and contracting interests in the Middle West. In the near future Mr. Muldaur hopes to hold a conference with representatives of these interests and to work out a practical line of action.

National Electrical Credit Association

The fifteenth annual meeting of the National Electrical Credit Association was held at Hotel Statler, Buffalo, on June 27, at which time there were representatives present from the New England Electrical Credit Association, New York Electrical Credit Association, Electrical Credit Association of Philadelphia, Electrical Credit Association of Chicago and Electrical Credit Association of the Pacific Coast. President Charles M. Wilkins, of Partrick, Carter & Wilkins, Philadelphia, presided.

Total membership of the five local associations comprising the National Association, as of June 1, 1914, was 500 electrical manufacturers and jobbers, and those engaged in allied and kindred lines covering the entire country. The summary of Mr. Vose, the secretary, showed that there were 15,723 names reported during the year to the five allied associations in the aggregate amount of $1,218,624.20; that the association generally showed a marked increase in activity in the use of the service, with a larger average of benefit accruing to each member than at any time in the history of the organization. The treasurer's report showed that the affairs of the association have been conservatively managed, with a comfortable balance in the treasury. A number of the operative resolutions were slightly modified, not in any way, however, changing the standard method of procedure. Telegrams of greeting were received from the Society for Electrical Development and from other friends. The association indorsed the campaign of the National One-Cent Letter Postage Association. It also gave favorable consideration to the invitation of the Panama-Pacific International Exposition to hold the next annual meeting at San Francisco in June, 1915, but before definite action could be taken on the invitation it was necessary to refer it to the several local associations.

These officers were elected: President, Mr. Frank M. Pierce, Manhattan Electrical Supply Company, Chicago; vice-president, Mr. Allan R. McDonald, Stewart-Howland Company, Boston; secretary-treasurer, Mr. Frederic P. Vose, Marquette Building, Chicago. Upon the retirement of Mr. Wilkins from the chair, which he previously occupied in 1899 and again in 1908, he was presented with a loving cup in recognition of his continuous service on the board of managers of the national association from its organization in 1898 to and including the date of this annual meeting. Secretary Vose, in presenting the cup, reviewed the service of Mr. Wilkins and not only credited him with being the originator of the principle of co-operative credit protection through an interchange of ledger experiences cleared through the local organizations covering the electrical and allied industries but also said that Mr. Wilkins was responsible for the organization of the Pacific Coast and Canadian associations, and that since the organization of the national association he had not missed a meeting of that body. In accepting the loving cup Mr. Wilkins made an appropriate response.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Business in Ignition Accessories Good.—The Connecticut Telephone & Electric Company, Meriden, Conn., has for several months been operating its factory night and day to keep step with orders.

Electric Hoist for Sand Pit.—The Patterson Sand Company, 2615 Crop Street, Louisville, Ky., is equipping its sand pit with an electric hoist to replace two mule teams and two drivers in getting the loaded wagons out of the pit. This pit is 50 ft. deep and the incline is 500 ft. long. Central-station energy will be used.

Large Number of Orders for Turbines.—In point of orders received, the past month has been one of the best in the history of the Terry Turbine Company, Hartford, Conn. Properly to take care of the increased business, additional machine tools have had to be installed, and the capacity of the plant has been increased 25 per cent.

Experimental Electric Oven for Navy Department.—One of the large units now being built in the factory of the Hughes Electric Heating Company is a 200-loaf baker's oven. This stove will be installed at one of the United States navy yards for experimental purposes, preparatory, it is thought, to equipping all battleships with electric ranges.

Semi-Direct Lighting for Office Building.—The Lathrop Building, Kansas City, Mo., is being equipped throughout with so-called "brascolite" fixtures made by the Luminous Unit Company, St. Louis, Mo. The fixtures for the lobby are hand-chased cast-bronze units with white enamel reflectors and inverted white glass bowls of artistic design. For the rooms and corridors fixtures with a white reflector fitting close to the ceiling, and with an ornamental white bowl suspended from the reflector on short brass spindles, are being used.

Vision Tests in Textile Mills Under Mercury-Vapor Lamps.—Experiments recently conducted in the Brighton Mills at Passaic, N. J., show that the average loom operator can see a white cotton-thread at a distance of 17 ft. in daylight. Under the rays of a mercury-vapor lamp, however, the same employees are able to see the same thread 24 ft. distant. Inasmuch as the continuity of the textile material produced depends upon quick observance of broken threads by loom operators, the mercury-vapor lamp has increased the efficiency of employees. There are 181 mercury-vapor lamps made by the Cooper Hewitt Electric Company in use at the Brighton Mills.

Duncan Company Building Testing Laboratory.—The Duncan Electric Manufacturing Company, Lafayette, Ind., has recently broken ground for a new meter-testing laboratory from which the daily output will be approximately 700 meters. All standard instruments used for testing are to be mounted on concrete piers extending 15 ft. below the floor level, so that all danger of the instruments being affected by tremors or vibration from trains on an adjacent track will be eliminated. Commenting upon industrial conditions, Mr. Thomas Duncan says that, although business is not at present up to its former standard, it is expected that the fall and winter seasons will see the company doing a larger volume of business than has hitherto been attained.

Demand for Electric Fans at Louisville.—More and better electric fans are being sold to householders in Louisville this season than ever before, according to reports from dealers in the city. The case of the Federal Electir Sign System as recounted by Mr. R. E. Brian, manager of the Louisville office, is typical. All last season the best this office could do was to sell 750 fans. This year, up to June 10, the same office had already sold more than a thousand fans. Preference is being shown for costlier, larger and more elaborate types than have been in demand in Louisville heretofore for domestic uses. The 12-in. and 16-in. oscillating types and also the slow-speed, six-blade types are in demand, whereas a year ago the 8-in. and 12-in. fans were getting the call.

New Electric Trucks for Boston Edison Company.—The Edison Electric Illuminating Company of Boston, Mass., is placing in service six new 2-ton electric trucks, the equipment having been specially designed for cable work. Each truck is equipped with an electrically driven winch and can easily raise a load of 1 ton from the ground to the floor of the truck in loading. The bodies are unusually rigid, the entire floor being lined with 8-in. steel. A double-throw switch prevents the truck from being started when work is being done with the winch. The controllers, switches, meters and other electrical equipment are assembled in a fireproof steel compartment, and the batteries are guaranteed to operate the truck at a speed of 40 miles per charge. The trucks will be used in pole erection as well as in cable construction, and were supplied by the General Vehicle Company.

Isolated Plants Discontinued in Chicago.—During the early part of June the owners of the Western Union Building and of the Transportation Building in Chicago signed contracts for electric service to be supplied by the Commonwealth Edison Company, discontinuing the operation of their isolated plants. The installation at the Western Union Building is interesting as indicating the confidence shown by the Western Union Company in the reliability of central-station service for operating its entire plant. The hydroelectric-elevator equipment in this building will be remodeled and the old steam pumps will be replaced by modern motor-driven turbine pumps. The Transportation Building, a twenty-three-story structure, with an equivalent of 1700 offices, presents a connected motor load of 700 hp and is lighted by about 4000 lamps. Up to the present this building has been receiving its energy from one 175-kw and two 200-kw direct-current machines, driven by reciprocating engines receiving steam from three 300-hp drum-type boilers. The building is owned by Mr. L. W. Hill and Mr. Watson P. Davidson, officials of the Northern Pacific Railroad, residing in St. Paul, Minn.

Electric Dumb-Waiters for Department Store.—Fifteen electric dumb-waiters are being installed in Altman's department store, New York. These dumb-waiters are operated from a single station. If the dumb-waiter is wanted at a certain floor, a button is pressed and the operator at the central station is signaled. The operator presses a button designated for the floor signaled, and the dumb-waiter is conveyed to that floor. As soon as the dumb-waiter arrives at its destination a signal lamp is turned on and the light can be seen from the outside through a small window in the sliding door. The operator also presses a button which causes a bell to be rung at the floor to which the dumb-waiter is bound. Buttons are provided inside the dumb-waiter for signaling to the operator at the central station to which floor the dumb-waiter is to be conveyed. The operation described above is then repeated. A signal lamp at the central station burns whenever the dumb-waiter is stationary and the hatchway door is unopened. The floor bell can also be used as a signal for the operator to the floor attendant to close the hatchway door or to hasten the use of the car. These dumb-waiters were made by the Burdett-Rowntree Manufacturing Company, 119 West Fortieth Street, New York. Ten electric dumb-waiters have also been installed by the above company in the McAlpin Hotel, New York, and sixteen have been placed in the Biltmore Hotel, in the same city.

Business in Electric Ranges Good.—The Simplex Electric Heating Company, Cambridge, Mass., is reported to be receiving a number of orders for its electric ranges. Among the noteworthy installations recently made by this company is that for the Rupert High School, Rupert, Idaho, which was described in the *Electrical World* May 23. Large-sized ranges have also been supplied to the Stanley Hotel, Estes Park, Col., and to the welfare department of the Edison Electric Illuminating Company, Boston, Mass.

A Million-Dollar Motor-Service Contract.—The American Manufacturing Company, the largest maker of bagging and cordage in the world, has signed a contract with the Edison Electric Illuminating Company of Brooklyn, N. Y., whereby the cordage company will abolish its 5500-hp isolated plant and use central-station service. This agreement is believed to be the largest contract for commercial electrical service ever signed by a central station. The contracted load is 4000 kw, the guarantee being for at least 3000 kw of demand, not more than 15 per cent of which is to occur during the central-station peak. The contract involves a change from direct-current motors to three-phase, twenty-five-cycle motors in the factory and the scrapping of a three-hundred-thousand-dollar plant. The change-over will require an outlay of approximately $80,000, and the contract, which is made for a term of years, will give the Brooklyn Edison Company a gross aggregate income of between $1,000,000 and $2,000,000. To secure the contract Mr. T. J. Jones, commercial agent of the company, recently made a trip to London, England, where the consulting engineers of the American Manufacturing Company are located. In addition to its magnitude, the present contract is also interesting as instancing a change made in the labor schedule of a large manufacturing concern solely to avoid crossing the central station's peak, thus enabling the customer to earn a lower rate. To facilitate central-station service the concern, which employs 2000 men at its Brooklyn plant, has agreed to close during November, December, January and February at 4.30 p. m. instead of at 5.30 p. m., making this radical change in its labor schedule to take advantage of the central-station off-peak schedule.

New England Central Station Business.—As was shown in the last two issues of the *Electrical World*, April returns from the central stations in the Atlantic and the Central States show a better rate of increase over last year than was indicated by the March returns. April reports from the New England companies confirm this finding. In the table herewith are shown the gross earnings from the sale of energy and the total station output of eight large New England companies, complete reports from which are available for the months of February, March and April. It is

COMPARISON OF EARNINGS AND OUTPUT FOR FEBRUARY, MARCH AND APRIL, 1913, AND 1914, OF EIGHT LARGE NEW ENGLAND COMPANIES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kilowatt-hours		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
February	$1,197,778	$1,079,490	11.0	30,095,621	27,217,230	10.6
March	1,093,502	1,020,796	7.1	32,516,426	30,192,934	7.7
April	1,063,880	977,530	9.0	29,818,976	27,236,993	9.5

difficult to see why the expansion coefficient for March should be as low as it is. It is an easy matter to explain the falling off in published income for that month compared with February, even while the station output for the calendar period showed an increase, but it is certainly singular that the actual rate of increase over the previous year should fall so far below the constant provided by the February and April returns. By way of confirmation it should be noted that a similar condition was reflected by the figures from the Middle Atlantic States, where April returned an increase over 1913 of 9.8 per cent on earnings and 10.1 per cent on output, against 6.1 and 7.5 for March, and by the South Atlantic States, where the rates for April were 12.7 and 26.1 against 10.7 and 25 for March. The Central States showed a similar condition of affairs. Since publication of the March New England data the *Electrical World* has canvassed the remainder of that field pretty thoroughly and has now received the April figures from twenty-five additional electric-service companies. These for the most part supply energy to the smaller communities—10,000 to 40,000 population—where the income is somewhat less than $20,000 per month. In the aggregate these additional returns show that gross earnings from the sale of energy increased from $406,725 in April, 1913, to $437,893 in April, 1914, or at a rate of 7.8 per cent; while total output increased in the same period from 11,944,995 kw-hr. to 13,567,648 kw-hr., or at a rate of 13.7 per cent. Combining these figures with the data already received for April from the eight larger utilities, the totals for thirty-three New England companies reporting to the *Electrical World* are as follows: Gross earnings, $1,501,773 for April, 1914, against $1,384,255, increase 8.5 per cent; total output, 43,386,624 kw-hr. against 39,181,988, increase 10.8 per cent. These results may be taken as being fairly representative of the New England territory, since it may be shown from the official census figures that in April, 1913, the gross earnings from the sale of energy for the whole area were around $2,750,000, while the total station output was in the neighborhood of 85,000,000 kw-hr. The *Electrical World* returns, therefore, cover some 45 per cent of the whole industry in New England, the major portion of the reports having been furnished by the Massachusetts companies.

Electrical Equipment for Steel and Iron Industry.—A number of orders have been received recently by the General Electric Company for equipment in steel and iron mills. The Cambria Steel Company, Johnstown, Pa., will install two 500-kw rotary converters and six 175-kva transformers. The American Bridge Company, Pittsburgh, Pa., has ordered a 4-ton storage-battery industrial locomotive. The Aluminum Ore Company, East St. Louis, Ill., recently ordered twelve 15-hp induction motors and compensators. The Forged Steel Wheel Company, Butler, Pa., will add to the electric-drive equipment of its plant eight 105-hp mill-type motors. The Hartford Machine Screw Company, Hartford, Conn., has ordered four additional 75-hp induction motors for electric drive. The Riter-Conley Manufacturing Company, Pittsburgh, ordered six centrifugal gas compressors. The Bourne-Fuller Company, Cleveland, Ohio, will add to the equipment of its power station a 200-kw motor-generator set and switchboard. The Southwark Foundry & Machine Company, Philadelphia, Pa., recently ordered a 425-hp induction motor and controller. The Dobbie Foundry & Machine Company, Niagara Falls, N. Y., will install for electric drive in its plant thirteen induction motors ranging in rating from 5 hp to 50 hp, three 2300-volt transformers, and accessories. The Cambria Steel Company, Johnstown, Pa., recently purchased a 375-hp induction motor and compensator. The American Iron & Steel Manufacturing Company, Lebanon, Pa., will install three 200-hp, five 300-hp and one 400-hp motor.

NEW YORK METAL MARKET PRICES

	June 23 Bid	June 23 Asked	June 30 Bid	June 30 Asked
Copper				
Standard spot*	13.30	13.70	....	13.50
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	61 0 0		60 1 3	
Prime Lake	14.00	to 14.25	13.75	to 14.00
Electrolytic	13.70	to 13.80	13.40	to 13.50
Casting	13.50	to 13.60	13.25	to 13.35
Copper wire base	14.62½	to 14.75	.....	to 14.37½
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.05	to 5.15	5.00	to 5.10
Tin, spot*	30.75	to 31.25	30.35	to 30.50
Aluminum:				
Prompt delivery	17.75	to 18.00	17.50	to 17.75
Future	17.75	to 18.00	17.50	to 17.75

*OLD METALS

Heavy copper and wire	12.50	12.75
Brass, heavy	8.25	8.50
Brass, light	7.25	7.37½
Lead, heavy	3.70	3.75
Zinc, scrap	3.75	3.85

*COPPER EXPORTS

Total tons to June 30 32,927

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Commonwealth Edison Company.—Under the ordinance of March, 1908, the Commonwealth Edison Company has paid to the city of Chicago $518,295 as its 3 per cent share in the gross receipts of the company for the year ended May 31, 1914. Last year the city received $473,010.

United Properties Corporation.—The agreements for the dissolution of the two-hundred-million-dollar United Properties Corporation are now on file with the California Railroad Commission. These agreements call for the segregation and separate financing of the corporations controlled by the merger. When this has been accomplished it seems to be the intention of the controlling interests to pay off the corporation's debts and then dissolve the corporation. The agreements further state that Messrs. Tevis and Hanford feel morally obligated to satisfy the numerous claims against the United Properties Corporation.

Southern Sierras Power Company Bonds.—Boettcher, Porter & Company, Denver, are offering at 99 and interest first mortgage sinking-fund 6 per cent gold bonds of the Southern Sierras Power Company. These bonds are unconditionally guaranteed as to principal and interest by the Nevada-California Power Company. The Southern Sierras Power Company owns steam and hydroelectric plants aggregating 15,666 hp, interconnected with the generating plants of the Nevada-California Power Company. The company also has 238 miles of double steel-tower high-tension transmission line and 630 miles of distributing system.

Adopts Stock Profit-Sharing Plan.—The National Carbon Company has announced a profit-sharing plan whereby $500,000 common stock is to be set aside for sale to employees. The shares will be sold at par in instalments, taking not less than three years or more than five years. The subscriptions will be governed by the yearly salary. Dividends will be credited to each stockholder from the date payments begin, and interest will be charged on unpaid payments at the rate of 4 per cent. A bonus of $5 a year will be paid to each shareholder. It is figured that the bonus and dividends with a monthly payment of $1 will pay for one share in four years and eight months. The plan will go into effect on July 15, 1914.

Texas Power & Light Company Escrow Bonds.—Messrs. Harris, Forbes & Company, of New York, are offering $700,000 of Texas Power & Light Company first mortgage 5 per cent gold bonds. These bonds are part of an authorized issue of $30,000,000, of which $4,790,000 are now outstanding. The remaining escrow bonds may be issued from time to time to the par value of 80 per cent of the cash cost of permanent extensions and additions to the property, provided that the net earnings for the preceding twelve months have been equal to at least twice the interest on all bonds outstanding, including those bonds to be issued. The company does the entire commercial lighting and power business in thirty-one cities and towns in a prosperous and thickly settled section of Texas, besides doing a gas business in five of these communities. The total population served is estimated to be over 190,000.

Michigan Railway Company Notes.—The National City Company, New York; Hodenpyl, Hardy & Company, New York, and E. W. Clark & Company, Philadelphia, have purchased the five-million-dollar issue of first-lien 6 per cent five-year gold notes of the Michigan Railway Company. These notes are secured by first mortgage through the pledge of the entire outstanding first-mortgage 5 per cent bonds on the entire property of the company and also through the pledge of all the outstanding obligations and stocks, excepting directors' shares, upon the property of the Springville Land Company. In addition, these notes have the unconditional guarantee of the Commonwealth Power, Railway & Light Company, of Jackson, Mich. The Michigan Railway Company owns a hydroelectric plant rated at 1000 hp, water rights on the Manistee River capable of development to the extent of 16,000 hp, and water rights on the Grand River in the city of Grand Rapids capable of developing 3000 hp.

Central Mexico Light & Power Company.—In a recent circular Curtis & Hine, general managers of the Central Mexico Light & Power Company, said that the directors voted to suspend payment of dividends on the cumulative preferred stock for the present. While the company has suffered no material loss and has succeeded in keeping all the plants in operation, the increasing disorder has reduced earnings and increased operating expenses, and the great depreciation of Mexican currency has involved serious losses in the transfer of funds to this country. The occupation of Vera Cruz by the American forces in April caused so much anti-American feeling that the American employees had to be withdrawn and Mexicans and foreigners substituted in their places. Arrangements have been made for the payment of all bond interest, sinking funds and other fixed charges for a considerable time to come, and it is stated that the company will probably be able to meet current operating expenses out of earnings so long as present conditions continue.

Suspends Dividend to Provide for Improvements.—The West Penn Traction & Water Power Company has suspended dividends on the $6,500,000 of preferred stock. This suspension was not caused by any decrease in the earnings of the operating properties, for these show substantial gains over last year. Under the indenture securing the recent issue of $6,000,000 notes by the West Traction Company the West Penn Traction & Water Power Company is required to expend in 1914 and 1915 at least $4,000,000 out of a part of the proceeds of these notes for improvements. Against these expenditures first-mortgage bonds, pledged as security for these notes, will be issued. Under the terms of the mortgage and note indenture the company must spend at least 28 per cent of the cost of such improvements before drawing upon the funds from the sale of the notes. This means that this year and next the company must take from its income more than $700,000 for improvements, and, therefore, in order to conserve the income of the company and maintain proper reserve, the dividends on the preferred stock were suspended. These dividends being cumulative will be paid back as soon as the cash reserves are built up to a proper point.

Washington Railway & Electric Company's Progress.—Owing to frequent inquiries in relation to the company's history, President Clarence P. King, in his annual report, has shown the growth of the company from the time of its founding up to the present. In 1899 there were eleven street railways, excluding the Capital Traction Company, and two electric-lighting companies operating in the District of Columbia and in adjacent portions of Maryland, each having its own organization and operating equipment. Then the idea was conceived of bringing them all under one management. The owners of the two electric-lighting plants therefore organized the Washington Traction & Electric Company, acquiring control of the following railroad companies: Anacostia & Potomac River Railroad Company, Brightwood Railway Company, Capital Railway Company, City & Suburban Railway of Washington, Columbia Railway Company, Georgetown & Tennallytown Railway Company, Metropolitan Railroad Company, Washington & Glen Echo Railroad Company, Washington & Rockville Railway Company and Washington, Woodside & Forest Glen Railway & Power Company. The organization erected a central up-to-date power station, rebuilt lines and installed new machinery and equipment. The venture did not prove a success, but, rather than go back to the old independent company system and all the attending discomforts, the Washington Railway & Electric Company was authorized by Congress to take over the Washington Traction & Electric Company. The new company by many economies has grown and thrived until it occupies its present position. To do this the smaller power houses were gradually abandoned, and now the company relies entirely on the Benning station of the Potomac Electric Power Company, a subsidiary company. The business of this power company has shown a satisfactory growth during the year. Its connected load has in the past thirteen years increased from 270,080 to 1,080,000 16-cp equivalents, and the number of meters installed from 2953 to 22,483. After making substantial additions to the Benning plant, its capacity is now 37,000 kw. The added load has been largely day load, thereby making a material improvement of load-factor. The Washington Railway & Electric Company, with a view toward efficiency and welfare of employees, has adopted several important measures.

Business Notes

Colgate, Parker & Company, of 2 Wall Street, New York, announce that they have admitted F. H. Davis to general partnership in the firm.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., has opened a sales office in Suite 524, University Block, Syracuse, N. Y. J. W. Bryant will be in charge of this office.

Santo Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa., is the new name of the Keller Manufacturing Company, manufacturer of the "Santo" vacuum cleaners.

Percival Robert Moses, 366 Fifth Avenue, New York.—R. L. Vaniman, formerly with Starrett & Van Vleck, has been appointed associate engineer and Western representative of Percival Robert Moses. His office will be in Vancouver, B. C.

The Adapti Manufacturing Company, Cleveland, Ohio, manufacturer of outlet boxes, has moved to larger quarters at 919 West Street, where the company will occupy an entire three-story building after July 1. The change in location has been made necessary by the recent increase in the company's business.

New Industrial Companies

The E. J. Bett Lighting Company, of East Liverpool, Ohio, has been incorporated by E. J. Bett and others. The company is capitalized at $10,000 and proposes to deal in lighting fixtures.

The Alday Manufacturing Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by H. A. Hauxhurst, M. T. Flanagan, F. X. Cull and others. The company proposes to manufacture motors and engines.

The Dunlap Electric Truck Company, of Columbus, Ohio, has been chartered with a capital stock of $20,000 to build electric trucks and manufacture accessories for electric vehicles. The incorporators are T. C. Dunlap, George R. Hedges, Stewart A. Hoover, Herman R. Tingley and M. E. Beasley.

The Premier Electrical Manufacturing Company, of Bridgeport, Conn., has been incorporated with a capital stock of $50,000. The company proposes to manufacture electrical wiring devices. The officers of the company are: President, F. A. North; vice-president, E. E. Forstom; secretary, W. E. French; treasurer, H. J. French.

Trade Publications

Trade-Mark.—The Lombard Governor Company, Ashland, Mass., announces through a circular that it has adopted a trade-mark.

Link Belts.—Section A of Catalog No. 110, issued by the Link Belt Company, Chicago, Ill., contains information on a detachable link belt

Tachometers.—A magneto-type tachometer is described in Bulletin No. 100, issued by the Electric Tachometer Company, Philadelphia, Pa.

Trolley Wire.—Advantages of Phono-Electric wire are outlined in a folder issued by the Bridgeport Brass Company, Bridgeport, Conn.

Talking Signs.—Electric talking signs are described and illustrated in Bulletin No. 210 of the National Electric Sign Company, Jersey City, N. J.

Motor Starting Switch.—The Allen-Bradley Company, Milwaukee, Wis., has issued Bulletin B-531, describing induction-motor starting switches.

Friction Clutches.—A folder stating the advantages of its friction clutch is being distributed by the Moore & White Company, Philadelphia, Pa.

Circuit-Breaker.—A booklet issued by the Sangamo Electric Company, Springfield, Ill., describes a storage-battery circuit-breaker for electric vehicles.

Telephone Bracket.—A telephone bracket attachable to any telephone is described in the folder issued by the Gee Electric Company, Wheeling, W. Va.

Cable Hangers.—Cable hangers and the method of installing them are illustrated in the leaflet sent out by W. N. Matthews & Brothers, St. Louis, Mo.

Flexible Duct.—A folder sent out by the Tubular Woven Fabric Company, 97 Warren Street, New York, refers to Duraduct, a flexible insulating tubing.

Steel Tubing.—Bulletin No. 17 A of the National Tube Company, Pittsburgh, Pa., contains an extract from an engineering article on seamless steel tubing.

Boiler Scale Removal.—"Scale Removal in Fire-Tube Boilers" is the subject of a bulletin recently issued by the Lagonda Manufacturing Company, Springfield, Ohio.

Arcless Indicating Fuses.—A leaflet issued by the Detroit Fuse & Manufacturing Company, Detroit, Mich., describes and illustrates its "Arkless" indicating inclosed fuses.

Wire Pick-Up.—A leaflet describing and illustrating a clamp for holding trolley wire temporarily, has been issued by the Electric Service Supplies Company, Philadelphia, Pa.

Textile Machinery.—Quarterly No. 7, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., relates to electrical equipment for textile mills.

Heating Devices.—A curling-iron heater and heating pad are described and the prices listed in the leaflet distributed by the Simplex Electric Heating Company, Cambridge, Mass.

Table Appliances.—A short one-act play entitled "Cooking Breakfast at the Table" has been printed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Cutout Lamp Hangers.—Single-cord lamp hangers which will open the circuit when the lamp is lowered are described in a folder issued by the Thompson Electric Company, Cleveland, Ohio.

Rubber-Insulated Conductors—Results of resistance and dielectric tests on rubber insulation are contained in a pamphlet distributed by the Hazard Manufacturing Company, Wilkes-Barre, Pa.

Electric Dumb-Waiters.—An illustrated cloth-bound catalog describing electrically operated dumb-waiters has been issued by the Burdett-Rowntree Manufacturing Company, 119 West Fortieth Street, New York.

Adjustable Fixture Hanger.—The "Knight" fixture hanger, which is adjustable for all ceiling outlets, is described in an illustrated catalog recently issued by the Empire Engineering & Supply Company, 227 Fulton Street, New York.

Plugs.—Harvey Hubbell, Inc., Bridgeport, Conn., has published a leaflet setting forth briefly the features of the new "fifty-8-fifteen" plug. This plug is small, so that when it is inserted in a socket the cap projects only a trifle more than 0.5 in.

High-Speed Printing Telegraph.—A twenty-three-page illustrated booklet printed in German has been sent out jointly by Siemens & Halske and the Siemens-Schukertwerke, Berlin, Germany, describing a new high-speed printing telegraph.

Connectors and Plugs.—A large poster issued by the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, shows its line of connectors and plugs. These are especially adapted for temporary connections, such as are used in stage work.

Electric Vehicles.—The Buffalo Electric Vehicle Company, 1219 Main Street, Buffalo, N. Y., has published a four-page folder in which are illustrated three types of lamp trimmers' or meter wagon for use by electric-lighting companies. Specifications are also given.

Testing of Coal.—The Electrical Testing Laboratories, Eightieth Street and East End Avenue, New York, have published an instructive booklet on "The Value of Coal for Power Purposes." Reference is made to the company's readiness to conduct any of the customary tests and analyses of coal.

Personal Mention

Mr. Wilmer F. Shauck has resigned as superintendent of the municipal lighting plant at Kendallville, Ind.

Mr. H. T. Willett has resigned as secretary of the Springfield (Ill.) Gas & Electric Company owing to ill health.

Mr. E. Shibler has been appointed secretary of the Archbold (Ohio) Electric Light & Power Company, to succeed Mr. G. DeVries, who recently resigned.

Mr. Frank J. Duffy, president and manager of the Southern Railway & Light Company, Natchez, Miss., has been elected president of the local chamber of commerce.

Mr. H. Whitford Jones, city electrical engineer, Cleveland, Ohio, has been retained by the City Council of Sandusky to assist the city in fixing rates for commercial and street lighting.

Mr. Thomas E. Murray, vice-president of the New York Edison Company, was elected a member of the board of trustees of the Emigrant Industrial Savings Bank at the last meeting of the board.

Mr. B. W. Lynch, formerly general auditor of the Consumers' Power Company of Minneapolis, Minn., has been appointed assistant to the general auditor of H. M. Byllesby & Company, to succeed Mr. N. P. Zech, resigned.

Mr. Aldus C. Higgins, secretary of the Norton Company, Worcester, Mass., has been awarded the John Scott Medal by the Franklin Institute of Philadelphia in recognition of his invention of electric-furnace methods for the production of alundum.

Col. Merritt M. Smith has been appointed chief engineer of the Department of Water Supply, Gas and Electricity of New York City, succeeding Mr. I. M. De Varona, who resigned recently after twenty-two years' connection with the department.

Mr. George W. Dunlap has been appointed superintendent of power stations of the International Railway Company, Buffalo, N. Y., in addition to his duties as superintendent of equipment. Mr. Dunlap was formerly superintendent of power for the Worcester (Mass.) Consolidated Street Railway Company.

Mr. William A. Bole has been appointed vice-president of the Westinghouse Machine Company, East Pittsburgh, Pa., in charge of production and erection. Mr. Bole has been continuously in the employ of the company since August, 1882, having filled successively the positions of general shop foreman, superintendent, manager of works and consulting engineer.

Dr. William McClellan has been appointed confidential engineer to the Public Service Commission of the First District of New York in connection with the valuation of the New York Telephone Company's property. Mr. McClellan was formerly chief of the division of light, heat and power for the commission, but for the last year has served as assistant to the president of the Buffalo General Electric Company.

Mr. Edwin Jowett has resigned as assistant to the chief constructing engineer of the Commonwealth Edison Company, Chicago, to become chief operating engineer of the Fort Worth (Tex.) Power & Light Company. He had been associated with the Chicago company since 1906, having spent the first six years as assistant to the chief engineer of the Fisk Street station. In 1912 Mr. Jowett was sent to England to inspect the construction of the new 25,000-kw Parsons turbo-generator set now installed in the Fisk Street station.

Mr. E. A. Quinn, of San Francisco, has assumed the position of general superintendent of the San Joaquin Light & Power Corporation, Fresno, Cal., succeeding the late Lloyd N. Pert, who was recently drowned in the San Joaquin River. Mr. Quinn was for several years general superintendent of the California-Nevada Power Company at Goldfield, Nev.; later he was connected with the Westinghouse Electric & Manufacturing Company at San Francisco, and for the last four years he has been general superintendent for the Allis-Chalmers Company at San Francisco.

Mr. Samuel F. Dibble, who has been manager of the small motors department of the General Electric Company, Chicago, has been made manager of the Duluth office of the same company. Mr. Dibble graduated from Michigan University in 1893 and during the summer and fall of the next year had charge of a portion of the exhibition made by the General Electric Company at the World's Fair. For the four succeeding years he served in the capacity of chief electrician at the Detroit municipal lighting plant, and for the last seventeen years he has been employed with the General Electric Company in Chicago.

Gen. George H. Harries, president of the Louisville (Ky.) Gas & Electric Company, received the honorary degree of doctor of laws at the forty-sixth annual commencement of the University of Kentucky at Lexington on June 4. In conferring the degree President Barker of the university referred to General Harries' military career and concluded with complimentary allusions to the work accomplished by the Louisville Gas & Electric Company and to "the fine public spirit which has been made apparent in the organization and conduct of the company—a high example worthy of complete imitation and all commendation."

Dr. William David Coolidge, assistant director of the research laboratory of the General Electric Company, Schenectady, N. Y., has received the Rumford Medal of the American Academy of Arts and Sciences for his invention of ductile tungsten and its application in the incandescent lamp and X-ray tube. Dr. Coolidge was born at Hudson, Mass., in 1873. He received the degree of bachelor of science from the Massachusetts Institute of Technology in 1896 and the degree of doctor of philosophy from Leipsic in 1899. Prior to going abroad, and again on his return, he was assistant in physics at the Massachusetts institute. Later he became instructor, then research assistant in theoretical and physical chemistry, and was assistant professor of physico-chemical research at the time of his transfer to the Schenectady laboratories. The Rumford Medal was established in 1839 by Benjamin Thompson (Count Rumford), a native of Woburn, Mass., who donated a fund the interest on which still provides for periodic awards of medals and money for pre-eminence in research work. Among those who have received the Rumford Medal are Capt. John Ericsson, Prof. Henry A. Rowland, Prof. Samuel P. Langley, Dr. Albert A. Michelson, Mr. Thomas A. Edison, Dr. Charles Francis Brush, Dr. Edward G. Acheson, Mr. Charles Gordon Curtis and Dr. Herbert E. Ives.

Col. William H. Chapman, who on July 1 retired as president and general manager of the Houston (Tex.) Lighting & Power Company after serving nearly seventeen years at the head of that organization, is one of the pioneers of the electrical industry, despite the fact that he entered this field in 1888 at an age when many less energetic men feel themselves entitled to a relaxation of active duties. Colonel Chapman was born Feb. 3, 1838, and for a number of years was superintendent of machinery at the Boston Navy Yard. In 1888 he joined the staff of the old Thomson-Houston Company and in this connection supervised the construction of power plants at Cleveland, Ohio; Mott Haven, N. Y.; Hoboken, N. J.; Natick, Mass.; Salem, Mass.; Gloucester, Mass., and other Eastern cities. Later he became engineer for the United Electrical Securities Company, which was closely identified in a financial way with the Thomson-Houston Company. In 1895 Colonel Chapman was appointed general manager of the Louisiana Electric Company, New Orleans, a position which he held three years. Early in 1898 he joined the Houston Lighting & Power Company as general manager, and a few years later he was elected president as well. Colonel Chapman's son, Mr. W. H. Chapman, Jr., is district turbine inspector in the New York office of the General Electric Company. Colonel Chapman has returned to his native city of Boston to live, but will visit New Orleans and Houston during the winter months of each year.

COL. W. H. CHAPMAN

Construction

New England

BOSTON, MASS.—Plans are being considered for the installation of a central power plant on Deer Island to furnish power to operate all the shops on the island.

BOURNE, MASS.—The contract for the construction of the new electric-power station to be erected on land owned by the canal company, near the highway bridge, it is reported, has been awarded to R. J. Ryder and Herman Handy.

MALDEN, MASS.—A movement is under way among the city officials and the Board of Trade to secure the equipment of the Saugus branch of the Boston and Maine railroad for electrical operation.

SPRINGFIELD, MASS.—Bids will be received at the office of the commanding officer, Springfield Armory, Springfield, Mass., until July 21, for furnishing about 26,000 pounds of medium, soft and hard brass wire and 38,000 brass tubes.

WORCESTER, MASS.—The Worcester El. Co., will soon submit the proposal to increase the capital stock from $1,300,000 to $1,400,000 to the stockholders, the proceeds to be used to pay for improvements being made at the Webster Street station and for extensions contemplated.

HOWARD, R. I.—Bids will be received at the office of the Board of Control and Supply, Room 18, State House, Providence, R. I., until July 9 for construction of laundry building, including plumbing, heating and electric wiring, for the State Hospital for the Insane at Howard. Plans and specifications may be seen at the above office and at the office of Eleazer B. Homer, architect, 87 Weybosset Street, Providence; heating plans may be seen at the office of Richard D. Kimball Co., 6 Beacon Street, Boston, Mass.

Middle Atlantic

BATH, N. Y.—Plans have been prepared for the installation of a municipal electric-light plant in Bath by Engineer Larrowe, of Cohocton. The plans provide for two steam-driven generating units; 117 tungsten lamps of 200 cp, with 67 boulevard lamps for use in the business section, parks and other places.

BINGHAMTON, N. Y.—The City Council has engaged Douglas Sprague, consulting engineer, 39 Cortlandt Street, New York, to take charge of the construction of the proposed municipal electric-light plant, for which $148,000 in bonds was recently voted.

BROOKLYN, N. Y.—Bids will be received by Robert Adamson, fire commissioner, headquarters of the Fire Department, Municipal Building, New York, until July 13 for furnishing all material, establishing and equipping an extension to the fire-alarm telegraph system in the borough of Brooklyn. Blank forms and further information may be obtained at the above office.

BUFFALO, N. Y.—Bids will be received by the commissioner of public works, Room 5, Municipal Building, Buffalo, until July 10 for the erection of a series of one-story stalls, sidewalk canopies, lavatories, ice boxes, offices, etc., and for making general repairs and improvements to present main buildings on the Broadway market grounds, on Broadway, between Gibson and Lombard Streets, Buffalo, as follows: (A) Masonry, concreting, carpentry, etc.; (B) metal work, structural iron, etc.; (C) roofing, metal work, etc.; (D) insulation of ice boxes, refrigerator doors, etc.; (E) plumbing, drainage, gas fitting, etc.; (F) electric wiring, conduits, etc. A separate and distinct proposal must be submitted for each division of the work. Specifications may be seen at the office of the deputy building commissioner, Room 6, Municipal Building, where blank forms of proposals and other information may be obtained. Francis G. Ward is commissioner of public works.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2351, Municipal Building, New York, until July 8 for furnishing and erecting electric transmission lines in the Southern Boulevard, between Evergreen Avenue and Emmet Avenue, Borough of Richmond. Blank proposal form, together with copy of contract, including specifications, may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until July 13 as follows: (1) for additions, alterations and repairs to electric equipment in Public Schools 2, 10, 27 38 and Morris High School, borough of the Bronx; (2) for installing electric equipment in Flushing High School, on Broadway, Whitestone Avenue and State Street, Flushing, borough of Queens. Blank forms, plans and specifications may be seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, borough of Manhattan, and also at branch office, 69 Broadway, Flushing.

WESTFIELD, N. Y.—Within the next two months the Electric Light Commissioners expect to purchase one 75-kva and one 100-kva, three-phase, 60-cycle, 2400-volt Westinghouse alternator (both belt-driven), and one 90-hp Lozier gas engine. Harry Mettendorff is superintendent.

BARBOURSVILLE, W. VA.—The City Council is considering the question of installing a municipal electric-light plant, to cost from $4,000 to $5,000.

GARY, W. VA.—The Tug River Pwr. Co., recently incorporated with a capital stock of $10,000, is planning to construct a hydro-electric power plant on the Tug River. The incorporators are J. J. Stout, G. C. Sledge, J. H. Barker, G. W. Kanode and H. N. Eavenson, all of Gary.

SOUTH BOSTON, VA.—The electric plant of the South Boston El. Lt. & Pwr. Co. was destroyed by fire recently, causing a loss of about $175,000. ....

WASHINGTON, D. C.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 7 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6940—580 ft. ¾-in. brass conduit. Philadelphia, Pa., Schedule 6940—5000 ft. ¾-in. steel electrical conduit. Bids will also be received until July 14 as follows: Annapolis, Md., Schedule 6946—3000 ft. silk-braid incandescent lamp cord. Brooklyn, N. Y., Schedule 6943—one lubricating oil-testing outfit, complete with electric motor, heating device, etc.: Schedule 6952—5700 lb. soft-rolled, flat-sheet copper; Schedule 6975—680 lb. soft-sheet copper; Schedule 6952—620 lb. drawn seamless brass tubing (⅝ in. outer diameter, 0.402 in. inner diameter); Schedule 6976—miscellaneous drawn seamless copper tubing; Schedule 6951—700 ft. drawn seamless steel tubing (1 in. outer diameter, 0.635 in. inner diameter). Bids will also be received until July 28 as follows: Mare Island, Cal., Schedule 6969—one motor-driven, slip roll, forming machine, 14 horizontal single feed pumps, etc., one motor-driven, four-plunger, hydraulic pump; Schedule 6968—one universal bench saw, complete with motor. Bids will also be received until Aug. 4 for furnishing three winches and one compound-geared electrically operated capstan with spare parts to be delivered at Brooklyn, N. Y., as per Schedule 6981. T. J. Cowie is paymaster-general, U. S. N.

WASHINGTON BARRACKS, D. C.—Bids will be received at the office of the engineer depot, United States Army, Washington Barracks, Washington, D. C., until July 6 for furnishing 4200 ft. of 212,000-circ. mil, stranded single-conductor, lead-covered cambric-insulated armored cable. For further information address Lt.-Col. Joseph Kuhn.

North Central

DECATUR, MICH.—At an election held recently the proposal to issue $15,000 in bonds for a new municipal electric-light plant was carried. About $5,000 has already been expended on the project.

DETROIT, MICH.—The contract for general electrical work for the 10-story building to be erected by David Stott at Wayne and Michigan Streets, Detroit, has been awarded to the John D. Templeton Co., of Detroit.

DETROIT, MICH.—Bids will be received by Charles A. Gadd, secretary of board of education, Detroit, until July 7 for construction of Kennedy and Harper Avenue school buildings; alterations and improvements to the Palmer School, and for equipment of power plant for Central High School Building. Bids will also be received until July 21 for construction of the Northern High School Buiildng.

GRAND RAPIDS, MICH.—The new Young Men's Christian Association Building, it is reported, will be equipped with an electric generating plant.

LANSING, MICH.—The Reo Motor Car Co., which is erecting a new power plant, will purchase an electric generating unit of about 500 kw. No other machinery of any importance will be needed. R. E. Olds is president.

CATAWBA, OHIO.—The village of Catawba is contemplating the installation of a municipal electric-lighting system. The cost of wiring the village and making the necessary connections with the high-tension transmission lines of the Ohio Ser. Co. at South Vienna, a distance of 5 miles, will come to about $5,000. An election will be held Aug. 1 to submit the proposal to the voters.

COLUMBUS, OHIO.—Bids will be received by S. A. Kinnear, director of public service, City Hall, Columbus, until July 14 for furnishing two 150-kw outdoor-type, self-cooled 2200/440-volt transformers. Plans and specifications and blank forms may be secured from the superintendent of the division of electricity.

COSHOCTON, OHIO.—Within the next two months the Lafayette Lt. & Pwr. Co. of Coshocton expects to erect a transmission line from New Comerstown to Dennison (33,000-volt, three-phase, 60-cycle). All material has been purchased.

GREENVILLE, OHIO.—The Public Utilities Commission has granted the Greenville El. Lt. & Pwr. Co. permission to issue $28,000 in capital stock, the proceeds to be used for improvements to its plant and purchase of equipment as follows: Brick addition to power house, purchase of a 1000-kw Curtis turbine, with switchboard instruments and exciter, one Wheeler condenser, steam pipe and condenser connections, one Stirling boiler, coal dump, etc.

NORWALK, OHIO.—At a special election held June 22 the proposal to issue $120,000 in bonds to erect a municipal electric-light plant was carried.

SANDUSKY, OHIO.—The City Council has engaged H. Whitford Jones, of Cleveland, consulting engineer, to assist the city in fixing rates for commercial and street-lighting. It is expected that in this connection Mr. Jones will work out a scheme for an ornamental lighting system for the business section.

SEVILLE, OHIO.—All bids received June 22 for an electric distribution system in Seville were rejected; new bids will be received until July 6. S. D. Hall is village clerk.

SIDNEY, OHIO.—Within the next two months the Sidney El. Lt. Co. expects to purchase a 500-kw, 60-cycle, three-phase, 2300-volt generating unit (probably turbine), exciter for above, surface condenser, and generator and exciter panels. F. D. Elwell is manager.

SPRINGFIELD, OHIO.—The Springfield Ry. Co., it is reported, is planning to increase the boiler capacity of its power house in Springfield, bids for which will soon be asked for.

WARREN, OHIO.—The Trumbull Pub. Ser. Co., of Warren, is planning to increase the output of its steam generating plant, to consist (possibly) of a 3000-kw steam turbine, 600 hp or 700 hp in additional boilers, new feed-water heaters, the rearrangements of high-tension transmission line and building of substations. This work will be done under the supervision of the construction department of the Doherty Operating Co. Equipment and material will be purchased immediately. E. L. Franklin is general manager of the Trumbull Public Ser. Co.

LOUISVILLE, KY.—Plans are being prepared by the Federal Chemical Co., owner of the Globe Fertilizer Works, for building a new plant, to replace the one recently destroyed by fire. A large part of the machinery will be operated by electricity.

WINCHESTER, KY.—Work has begun on the construction of a garage for William Day, electrician, which will be equipped for recharging electric batteries and other electrical apparatus.

KNOX, IND.—The Public Service Commission has authorized Thomas A. Grist, proprietor of the Knox El. & Pwr. Co., to borrow $25,000 to make improvements to its system. A day service will be established when improvements are completed.

TELL CITY, IND.—Bids will be received by the city clerk, Tell City, until July 14 for new equipment for power plant, consisting of one 300-kw turbine and condenser with auxiliary apparatus for same; also motor-driven centrifugal pumps for pumping city water supply, together with necessary switchboard and accessories. For details see proposal columns. Specifications may be obtained from Robert M. Cass, consulting engineer, 318 American Life Building, Indianapolis.

ASHLAND, ILL.—The Abbott Lt. & Pwr. Co., of Petersburg, will install two substations in Ashland, the equipment to include one constant-current regulator and two 75-kva, 16,500-2300-volt transformers. Poles, wire, cross-arms and insulators are needed for 6 miles of line. Electricity for operating the system will be supplied from the generating station in Petersburg.

HAVANA, ILL.—Plans are being prepared for the installation of an ornamental street-lighting system, to be maintained by a special plant to be installed by the city.

Direct current will be used. Specifications not yet completed for plant. Plans for lighting system provide for 44 posts, 14 ft. high, to correspond with the Hersfield & Piper Co.'s, Taylorville, post, equipped with four 40-watt lamps and one 60-watt lamp, maintained by underground wires (three-wire system will be used). The cost of the system is estimated at $2,450, bids for which will soon be advertised. L. W. Ames is secretary of the Havana Commercial Club.

JOLIET, ILL.—Bids will be received by the Board of Inspectors of the City Schools of Joliet until July 15 for the construction of a new grade school, separate proposals to be submitted as follows: General construction, heating and ventilation, heat regulation, plumbing, sewering and gas-fitting and electric wiring. Drawings and specifications may be seen at the office of the Board of Inspectors, Joliet, at the office of John D. Chubb, architect, 109 North Dearborn Street, Chicago, Ill., and also at the Builders' Exchange, Milwaukee, Wis.

KANKAKEE, ILL.—Bids will be received until July 23 for the construction complete of a lodge and club house for the Order of Elks. Plans and specifications may be seen at the office of H. L. Crawford, secretary, at Kankakee. Separate bids to be submitted for heating, plumbing and electrical work. Charles P. Rawson, of Chicago, is architect.

LEE, ILL.—The local electric-light plant, owned by John Maumberg, was recently destroyed by fire, causing a loss of about $6,000.

URBANA, ILL.—Bids will be received at the office of the state architect, Room 648, 29 South La Salle Street, Chicago, Ill., until July 25 for construction of addition to Chemistry Building and Administration Building. Separate bids will be received for plumbing, heating and ventilation and electrical work. Plans and specifications may be obtained at the office of J. B. Dibelka, 29 South La Salle Street, Chicago, upon deposit of $10, which will be refunded upon return of same. J. M. White is supervising architect for the University of Illinois.

BURLINGTON, WIS.—The Burlington El. Lt. & Pwr. Co. is contemplating the installation of a new street-lighting system. The company, it is reported, would like to receive estimates on both electric arc lamps and tungsten lamps (750 to 1000 watts).

MILWAUKEE, WIS.—The City Council has confirmed the appointment of F. A. Vaughn, of Milwaukee, as engineer, to make a survey of the streets for the purpose of improving the street-lighting system.

RACINE, WIS.—Bids will be received by the Board of Public Works until July 11 for the installation of electric lamps on State and Fourth Streets bridges. Plans may be seen at the office of the city clerk.

BAGLEY, MINN.—The Council has engaged J. F. Druar, consulting engineer, Commercial Building, St. Paul, to prepare plans for rebuilding the municipal electric-light plant in Bagley.

BIRD ISLAND, MINN.—The Renville County El. Co., of Bird Island, is planning to erect a transmission line to Buffalo Lake, passing through the village of Hector, where the company will furnish power. It also proposes to build a line to the village of Olivia, where energy will be supplied at wholesale. The local power plant will be enlarged to take care of the increased load, plans for which are not yet completed, but will probably include the following equipment: One 150-hp to 200-hp return tubular boiler, one 175-hp Corliss or non-releasing Corliss engine, one 75-kw and one 150-kw, three-phase, 60-cycle, 2300-volt generator; three switchboard panels, with necessary instruments, switches, etc.; 15 to 20 2300-volt transformers (sizes 2 kw to 10 kw); three outdoor transformer stations (13,200-volt line); 45 miles of wire, insulators, etc.; 150 Westinghouse meters; all supplies to be carried by the company, which will contract for power installations and house wiring. J. H. Yarnell is manager.

LITTLE FORK, MINN.—The contract for installing an electric-light plant in Little Fork for S. S. Chapelle has been awarded to H. E. Dudrey, of Moorhead. None of the material has been purchased as yet, with exception of poles, which are now being erected. Alternating-current 60-cycle system is to be installed.

OWATONNA, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until July 14 for erection and completion of recreation building, dormitory building, enlarging main dining room and fireproofing south wing of main building, and addition to cow barn at State Public School, Owatonna, including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received collectively and separately. Copies of above plans and specifications may be seen at the Builders' Exchanges at St. Paul and Minneapolis, at the office of the superintendent at the above institution, and at the office of the State Board of Control, St. Paul.

DENISON, IA.—Plans are being prepared by J. B. Hill, of Iowa City, consulting engineer, for construction of a municipal electric-light and power plant in Denison.

LORIMOR, IA.—The Council has granted Gilbert Johnson, of Osceola, a franchise to construct and operate an electric-light plant in Lorimor. It is understood that a temporary plant will be installed to furnish electrical service until a transmission line is erected from a power plant in some other city.

ST. JOSEPH, MO.—Plans are being considered by the City Council to enlarge and improve the municipal electric-light plant.

WESTBY, N. D.—Preparations, it is reported, are being made for the installation of an electric-light plant in Westby.

PARKER, S. D.—Plans and specifications are being prepared by J. F. Druar, consulting engineer, Commercial Building, St. Paul, Minn., for the installation of an electric-light plant and extensions to water-works system, to cost about $27,000.

NELIGH, NEB.—Plans are being considered, it is reported, for remodeling the local electric-light plant.

CANTON, KAN.—The city of Canton will install a small electric-light plant in the near future. The equipment required will consist of a 35-kw, three-phase, 60-cycle, 2300-volt generator, exciter, switchboard, line material, series street-lighting system, meters, etc. Philip R. Dunton, of McPherson, is engineer in charge.

OTTAWA, KAN.—The erection of an electric transmission line between Ottawa and Marais des Cygnes is reported to be under consideration by the electric company in the latter place. The Bushong Electrical Co., of Ottawa, it is said, is interested in the project.

POWHATTAN, KAN.—The City Council has engaged G. E. Johnson, engineer, to take charge of erecting transmission line and distributing system, for which $10,000 in bonds was recently voted. L. C. Christensen is city clerk.

Southern States

FITZGERALD, GA.—Within the next three months the Fitzgerald Water, Light & Bond Commission expects to install one 500-hp automatic four-valve Harrisburg engine for direct connection to alternating-current generator, 150 r. p. m.; one 375-kva Fort Wayne 60-cycle, 2300-volt generator, one 18-kw. 125-volt exciter, one marble switchboard, equipped with necessary instruments, one Cochrane open feed-water heater, one Platt Iron Works boiler-feed pump and accessories. W. A. Green is superintendent.

HAWKINSVILLE, GA.—The city of Hawkinsville is planning to increase the output of the municipal electric-light plant and will purchase a 75-kva, 60-cycle, 2000-volt generator and engine, directly connected. E. L. Wilson is superintendent.

LA GRANGE, GA.—Bids will be received by J. D. Edmundson, Mayor, until July 21 for furnishing materials and constructing water-works system with all appurtenances, including filters, two brick stations, reinforced concrete, coagulating and clear-water basin, transmission line and electrically operated pumping machinery. Drawings and details and blank form of specifications may be obtained from T. J. Hartwell, city clerk, La Grange, or from James Nisbet Hazlehurst, consulting engineer, Atlanta, Ga.

REYNOLDS, GA.—The Town Council has engaged an engineer connected with the J. B. McCrary Co., of Atlanta, Ga., to make surveys and prepare plans for a municipal electric-light plant in Reynolds. As soon as plans are completed bids will be asked. G. L. Cooper is clerk.

MEMPHIS, TENN.—Bids will be received at the office of C. C. Pashby, city clerk, until July 14 for furnishing material and erecting pumping station, 60 ft. by 160 ft. and 99 ft. high, including discharge basin; also for furnishing and installing electrical machinery and auxiliaries as follows: Four 750-hp wound-rotor induction motors with horizontal shaft; two 300-hp wound-rotor induction motors with vertical shaft; one switchboard, complete for control of above motors with all wiring connections; three 667-kva, single-phase transformers and other auxiliaries. Bids will also be received at the same time and place for four double-suction horizontal-shaft, centrifugal pumps, each having a capacity of 300 cu. ft. per second against a normal head of 15 ft.; two vertical-shaft single-suction, centrifugal pumps, each having a capacity of 80 cu. ft. per second, against a normal head of 22 ft.; complete suction and discharge pipes for above pumps; one 20-ton motor-hoist hand-operated traveling crane, two vertical shaft-pit pumps, two rotary motor-driven vacuum pumps of 400 cu. ft. per minute each, together with necessary piping and valves. Contracts for electrical machinery, pumping machinery and building will be let separately or collectively. Plans and specifications may be obtained from J. H. Weatherford, city engineer, Court House, Memphis.

JACKSON, ALA.—Plans are being considered for the installation of a municipal electric-light plant and water-works system. It is proposed to operate the plant with a gas engine.

JENNINGS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 21 for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Jennings, La. Drawings and specifications may be obtained from the above office or from the custodian of site at Jennings. O. Wenderoth is supervising architect.

ST. MARTINSVILLE, LA.—The installation of an electric-light plant in St. Martinsville is under consideration.

DEVOL, OKLA.—The City Council is contemplating the installation of an electric-light system in Devol.

FAIRLAND, OKLA.—The Fairland Lt. & Pwr. Co. expects to install within the next two months a 60-hp boiler and a 50-hp. engine (already purchased). The company will purchase a 30-kw to 50-kw alternating-current generator. L. H. Long is manager.

McCLOUD, OKLA.—The City Council has engaged the Benham Engineering Co., American National Bank Building, Oklahoma City, to prepare plans for the erection of a transmission line from Shawnee to McCloud and to construct a distributing system for street and commercial lighting in McCloud.

CHILDRESS, TEX.—The local electric-light and ice plants were destroyed by fire recently, causing a loss of about $30,000. The city will be without electrical service until the plant is rebuilt.

CUERO, TEX.—The Texas Southern Electrical Co., of Boston, Mass., it is reported, has engaged the Scofield Engineering Co., Commercial Trust Building, Philadelphia, Pa., as consulting engineer. The Texas company recently purchased the public utilities in Cuero, Victoria, Kingsville, Bishop and Beeville. It is understood that the plants will be consolidated and improvements made, involving an expenditure of about $1,000,000.

DAYTON, TEX.—The Dayton Lt. & Pwr. Co., recently organized, with a capital stock of $20,000, is planning to construct an electric-light plant here. A. E. Kerr is interested in the project.

HANDLEY, TEX.—Plans are being considered by the Handley Commercial Club to secure the installation of an electric-lighting system here.

Pacific States

ASTORIA, WASH.—Arrangements are being made by the Northwestern Electric Co., of Portland, for the construction of a large hydroelectric plant on the White Salmon River, 12 miles from Astoria. Orders for electrical equipment, it is understood, have not yet been placed.

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 25, for furnishing and installing one 40-kw turbine-driven exciter in the central power plant at the navy yards, Puget Sound, Wash. Plans and specifications may be obtained on application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

SEATTLE, WASH.—The finance committee of the City Council has approved an appropriation of $10,000 to construct a 76-in. penstock from dam to power house at the Cedar River plant. When penstocks are completed the second unit can be installed in the power house, increasing the output by 10,000 kw.

AUMSVILLE, ORE.—Work will soon begin on the construction of an electric light and power plant for the Aumsville Flour Mills Co., which will furnish electricity for lamps and motors in Aumsville and surrounding territory.

MAPLETON, ORE.—The contract for the construction of a hydroelectric plant near Mapleton has been awarded by Richard Clough to C. A. Elkins and Frank Shelley, of Eugene. The plant when completed will supply electricity in Mapleton and vicinity.

TILLAMOOK, ORE.—The City Council has granted a franchise to F. D. Small and D. C. Urie to install an electric-light plant. Under the terms of the franchise not less than $30,000 must be expended on the project within 18 months.

COALINGA, CAL.—The Midland Counties Pub. Ser. Corpn., successor to the Coalinga Wtr. & El. Co., has petitioned the State Railroad Commission for authority to issue $650,000 in capital stock, the proceeds of $410,000 to be used to take up floating indebtedness and the remainer for new construction work. The present plans provide for the erection of a transmission line from San Miguel to San Lucas, a distance of 20 miles; from San Miguel to Jolon, 35 miles; San Luis Obispo to Cambria, 35 miles; San Miguel through Natralla, Chelame and Stone Canyon Valleys, 30 miles; Santa Maria to Lompoc, 60 miles, and from Port San Luis to Avila, 7 miles, together with distributing system, transformers and meters for service in the towns of Morros, Cayucos, Cambria, Bradley, San Ardo, San Lucas, Shandon, Parkfield, Jolon, Banta Ynez, Solvang, Orcuta, Los Clivos and Los Alamos.

OROVILLE, CAL.—The substation of the Pacific Gas & El. Corpn. on High Street was recently destroyed by fire, causing a loss of about $10,000.

VICTOR, IDAHO.—The installation of an electric-light plant to furnish electricity for the Victor and adjacent territory is under consideration by the City Council.

OGDEN, UTAH.—The Board of City Commissioners has authorized the extension of the ornamental street-lighting system on three more streets in the business district of the city. The city engineer has been instructed to take up the matter with the Utah Lt. & Pwr. Co., the Ogden Rapid Transit Co. and the Weber Club immediately.

CHOTEAU, MONT.—Extensive improvements are contemplated by the Choteau Lt & Pwr. Co. to its system this summer, including the installation of a new generator and other electrical equipment.

LIVINGSTON, MONT.—Plans are being prepared for the installation of an ornamental street-lighting system in Livingston, which provide for the erection of 616 ornamental lamp standards, of which 462 will be mounted with 100-watt lamps, with 12-in. Albia globes, and 154 with 300-watt lamps with 16-in. Albia globes (not yet decided whether tungsten or nitrogen lamps will be used), maintained by underground wires, of which 59,000 ft. will be required. The cost of the work is estimated at from $40,000 to $45,000. Not yet decided when contracts will be awarded. William S. Hartman is city engineer.

WARM SPRINGS, MONT.—Within the next two months the Montana State Hospital for the Insane expects to erect 1 mile of distribution line for alternating-current motor circuit and 1 mile of line for alternating-current lamp circuit. E. Pascoe is electrician.

LOVELAND, COL.—Plans have been filed by the Great Western Land, Granite, Lt., Pwr. & Mfg. Co., of Loveland, with the county recorder for the construction of a pipe line (to cost $8,000) which will furnish water to operate a large plant to be situated in the mountains west of this city. Victor L. Arenschield is president of the company.

Canada

CASSELTON, N. B.—Within the next two months Lloyd Lynch and Chester Hallett, owners of the local electric-light plant, expect to install a 25-hp Fairbanks-Morse oil engine and a 15-kw, 220-volt direct-current generator to take care of the day load. Ten additional street lamps are being installed.

ORILLIA, ONT.—Tenders will be received by the secretary of the Orillia Water, Light and Power Commission until July 27 for furnishing the following apparatus: Contract (E) furnishing and erection of motor-driven turbine pumps and equipment; (F) furnishing and erecting Diesel oil engine and appurtenances; (G) furnishing and erection of mechanical pressure-type filtration plant. Plans and specifications may be seen at the office of the commission, at Orillia. W. K. Greenwood is engineer, and E. Long chairman of commission.

MONTREAL, QUE.—The Montreal Lt., Ht. & Pwr. Co., it is reported, has decided to accept the conditions of the tentative agreement for lighting St. Catherine and Bleury Streets, under which the company will furnish the energy and part of the equipment at $72 per lamp per annum.

MONTREAL, QUE.—The report of the Electric Service Commission recommending that tenders for the construction of underground conduits on portions of Craig, Notre Dame and St. James Streets be called for has been adopted by the Montreal Board of Control. Bids for the above will be received until July 10.

Miscellaneous

FAIRBANKS, ALASKA.—Plans are being considered by John L. Timmins, John H. Hughes and others, of Fairbanks, for the construction of a large hydroelectric power plant on the Totatlanika River, 60 miles from Fairbanks, and a short distance from the Nenana coal fields, work on which, it is understood, will begin next spring. The proposed plant will have an output of 10,000 hp and will furnish electricity for the entire mining region of central Alaska.

New Incorporations

HARTFORD, CONN.—Articles of incorporation have been filed with the Secretary of State by the Manila Pwr. Co. of Hartford. The company is capitalized at $1,000,000 and proposes to own and operate transmission lines to distribute electricity for lamps, heaters and motors; also gas, water, refrigerating and bottling plants. The incorporators are William Waldo Hyde, Alvan Waldo Hyde and Arthur L. Shipman, all of Hartford.

PORTLAND, MAINE.—The Maine Rys., Lt. & Pwr. Co. has filed articles of incorporation under the laws of the State of Maine with a capital stock of $1,000,000, for the purpose of dealing in securities of all kinds. The officers are: Hugh J. Chisholm, president; Frank H. Bradford, treasurer, and Josiah H. Drummond, clerk, all of Portland.

CLARKSTON, MICH.—The Oakland Pwr. Co. has been incorporated to furnish electricity and gas in Clarkston, Waterford, Drayton, Palins and other villages.

ANNCAR, NEB.—The Niobrara El. Lt., Pwr. & Ry. Co. has been incorporated with a capital stock of $300,000 to do a general light and power business and operate a railroad. The officers are: Hugh O'Neill, president; C. L. Keeler, vice-president; Carl W. Grant, secretary, and John Korab, treasurer.

WINDOM, TEX.—The Windom Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by A. L. Clark, J. J. Cappleman and E. P. Price.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Fall meeting, Niagara Falls, N. Y., Oct. 1-3.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 State St., Troy, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meeting, Sept. 14, Greenbrier Hotel, White Sulphur Springs, W. Va.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Allan Sullivan, 610 Confederation Life Bldg., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary J. F. Becker, 1170 Broadway, N. Y.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russel, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., N. Y. Sections in New England, Chicago, Philadelphia, Washington and Los Angeles.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

FRANKLIN INSTITUTE. Secretary, Dr. R. B. Owens, Philadelphia, Pa.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. M. Clayton, Atlanta, Ga.

HYDROELECTRIC SECTION, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh. Annual meeting, Cleveland, Sept. 21, 1914.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, Grand Rapids, Mich.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Atlantic City, N. J., Sept. 15-18.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. Congress, San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN ELECTRIC ASSOCIATION. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary - treasurer, H. F. Wheeler, Hattiesburg, Miss. Next annual meeting, Hattiesburg, April 12-14, 1915.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer. F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, Detroit, July 15-18.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, J. B. Earle, Waco, Tex.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Narragansett Pier, R. I., Sept. 2-4.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 239 W. 39th St., New York.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary. R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 20-24.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa. Annual meeting, Eagle's Mere, Pa., Sept. 8-11.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer. C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Bldg., Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 23, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,100,708. ELECTRIC-CURRENT SHUNT; W. L. Brooks, Schenectady, N. Y. App. filed Nov. 4, 1912. Has negligible inductance, intended for large current alternating-current circuits.

1,100,709. ELECTRIC FURNACE; J. W. Brown, Lakewood, Ohio. App. filed Jan. 8, 1912. Material, such as granular carbon, moves at a uniform rate through the zone between the heating electrodes.

1,100,721. SYSTEM OF SHIP PROPULSION; W. L. R. Emmet, Schenectady, N. Y. App. filed Nov. 23, 1909. Duplicate port and starboard power sets in the form of propeller-driving motors served from turbine-driven generators.

1,100,723. POTENTIAL INDICATOR; E. F. Gehrkens, Pittsfield, Mass. App. filed April 8, 1912. For indicating voltage at some predetermined distant point on a transmission line.

1,100,731. TROLLEY; G. W. Hamilton, Edgewood Park, Pa. App. filed June 28, 1911. For mine locomotives; adaptable to various elevations and lateral displacements.

1,100,736. TRANSFORMER-TANK BREATHER; A. Hundt, Pankow, Germany. App. filed Oct. 29, 1912. Has moisture-removing means which acts only on the air passing from the exterior to the interior of the tank.

1,100,744. TROLLEY-WIRE SPLICE; W. H. Kempton, Mansfield, Ohio. App. filed Feb. 26, 1912. Has inclined bores for the ends of the trolley wire and clamping screws.

1,100,748. SPEED REGULATOR; H. A. Laycock, Schenectady, N. Y. App. filed July 11, 1913. For shunt-wound and compound-wound motors.

1,100,749. MANUAL-CALL-DISTRIBUTING SYSTEM; J. H. Levis, Jr., Rochester, N. Y. App. filed Dec. 29, 1913. "Call operator" answers incoming calls and distributes the calls manually to idle operators.

1,100,767. SIGNAL APPARATUS; H. F. Newbury, New York, N. Y. App. filed Nov. 26, 1904. Special elevator signal system.

1,100,786. CONTROL APPARATUS; W. M. Scott, Radnor, Pa. App. filed Aug. 4, 1913. Motor-operated distant control.

1,100,789. TIME-ELEMENT DEVICE; J. G. Statter, Wilmslow, England. App. filed July 14, 1913. Slightly separated sucker elements with co-operating concave-convex conical surfaces.

1,100,792. TROLLEY-WIRE HANGER; N. W. Storer. Pittsburgh, Pa. App. filed Dec. 2, 1909. For catenary systems; embodies an interposed substantially elliptical strap spring.

1,100,795. TYPEWRITING MACHINE; C. H. Vogel, Vancouver, B. C., Canada. App. filed Aug. 22, 1910. Electromagnets complete the depression of the key initiated by the finger touch.

1,100,817. SEMI-AUTOMATIC SIGNAL MECHANISM; R. G. Balcaen, Rochester, N. Y. App. filed Oct. 16, 1912. Dynamic indication electric interlocking.

1,100,832. ELECTRIC FLAT-RATE CONTROLLER; F. Kraemer, Chicago, Ill. App. filed March 14, 1907. For intermittently breaking the supply circuit whenever

attempt is made to add fraudulently to the authorized load.

1,100,856. TELEPHONE SYSTEM; A. R. Tucker, Lott, Tex. App. filed May 24, 1913. For eliminating eavesdropping on a party line.

1,100,857. ELECTRICAL APPLIANCE; S. B. Van Ranst, Syracuse, N. Y., and M. Havens, Jr., Albany, N. Y. App. filed Feb. 21, 1907. Outlet socket for conduits.

1,100,859. LINE-WIRE FASTENER; T. A. Wiseman, Winchester, Tenn. App. filed Sept. 13, 1913. For clamping telephone or telegraph wire to supporting insulator.

1,100,860. ELECTRIC INDICATOR SYSTEM; F. W. Wood, New York, N. Y. App. filed July 24, 1912. Ship's telegraph.

1,100,883. WATTS-PER-CANDLE PHOTOMETER; H. E. Ives, Mount Airy, Pa. App. filed March 10, 1913. For finding the voltage at which lamps will give their standard efficiency or watts-per-candle-power.

1,100,895. MEANS FOR INFLUENCING THE VARIATIONS OF MAGNETIC FIELDS; F. G. Liljenroth, Vesterås. Sweden. App. filed Feb. 15, 1912. For effecting a more rapid variation of a magnetic field.

1,100,917. SIGN-FLASHING MECHANISM; W. S. Ryan, New York, N. Y. App. filed Oct. 28, 1912. Auxiliary contact on the main rotating contact breaks the circuit with a snap action.

1,100,949. SWITCH; S. F. Briggs, Milwaukee, Wis. App. filed April 27, 1911. Auto "kick switch" with detents holding it in set position and capable of being pushed in to close a push-button circuit.

1,100,957. CIRCUIT-CLOSER; A. L. Davis, Clinton, S. C. App. filed Sept. 20, 1911. On railway track and operated by train to control traffic gates.

1,100,960. TROLLEY WHEEL; E. U. Down, Bowling Green, Ohio. App. filed Jan. 25, 1913. Special harp and brush construction.

1,100,964. MOTOR CONTROLLER; C. T. Evans, Milwaukee, Wis. App. filed Sept. 9, 1912. Compound starter for both starting and regulating.

1,100,972. ELECTRICAL FURNACE FOR THE REDUCTION OF COPPER AND OTHER ORES; W. H. Hamilton, New York, N. Y. App. filed Oct. 7, 1913. Plurality of shafts with electrical resistance heaters in their walls.

1,100,993. CONTACT FOR ELECTRIC FURNACES; F. T. Snyder, Oak Park, Ill. App. filed Oct. 28, 1912. Means for cooling the bottom contact or electrode.

1,100,994. DOOR FOR ELECTRIC FURNACES; F. T. Snyder, Oak Park, Ill. App. filed Oct. 28, 1912. Made to plug accurately the charging opening, and reversible to keep the coolest side toward workman.

1,100,995. ELECTRIC FURNACE; F. T. Snyder, Oak Park, Ill. App. filed Oct. 28, 1912. Special roof arch or dome of brick construction.

1,100,997. APPARATUS FOR THE PRODUCTION OF OZONE; J. Steynis, New York, N. Y. App. filed Oct. 27, 1913. Dielectric tube and inner electrode both carried by the outer electrode.

1,101,014. FLAMING-ARC ATTACHMENT FOR INCLOSED-ARC LAMPS; H. G. Dyer, Collingswood, N. J. App. filed Jan. 17, 1913. For converting ordinary inclosed-arc lamps into flaming-arc.

1,101,016. ELECTRIC CAR HEATER; T. Farmer, Jr., New York, N. Y. App. filed July 5, 1913. Heater compartments in communication with a continuous air duct.

1,101,018. SIGNALING CIRCUIT FOR TRAIN-DISPATCHING SYSTEMS; J. C. Field, Orange, N. J. App. filed March 30, 1911. Any way station on the line can signal any other way station without assistance of the sending or dispatching system.

1,101,027. TRANSFORMER; S. E. Johannesen, Pittsfield, Mass. App. filed April 2, 1909. Straps compress the laminations and serve for lifting the core and canopy from the casing.

1,101,033. DEVICE FOR CAPPING OFF GLASS CYLINDERS; C. T. Moore, Lancaster, Ohio. App. filed Sept. 29, 1913. Encircling heated wire with means for taking up the slack due to the expansion of the wire.

1,101.036. RAILWAY TRAFFIC-CONTROLLING APPARATUS; B. F. Oler, Elmhurst, N. Y. App. filed Nov. 26, 1912. Switch-throwing and signaling mechanism.

1,101,039. RAILWAY TRAFFIC-CONTROLLING APPARATUS; G. R. Scattergood, Philadelphia, Pa., and H. A. Wallace, New York, N. Y. App. filed Dec. 14, 1912. Applied to cross-over having two switches.

1,101,040. RAILWAY TRAFFIC-CONTROLLING APPARATUS; G. R. Scattergood, Philadelphia, Pa., and H. A. Wallace, New York, N. Y. App. filed Dec. 14, 1912. Special indication apparatus.

1,101,050. MEANS FOR OPERATING LIQUID ELECTRIC CONTROLLERS AND STARTERS; R. F. Baerlocher, Brighton, England. App. filed Nov. 12, 1913. Time taken in starting and accelerating the motor is automatically limited independent of the speed of operating the starting lever.

1,101,051. ALTERNATING-CURRENT DISTRIBUTING SYSTEM; G. Berry, West Drayton, Eng. App. filed Oct. 17, 1908. Employing in a single-phase system a plurality of main transformers and a supplementary transformer.

1,101,055. ELECTRICAL APPARATUS; T. A. C. Both, New York, N. Y. App. filed Nov. 8, 1910. "Flush receptacle."

1,101,056. BURGLAR ALARM; G. A. Brewster, New York, N. Y. App. filed May 29, 1912. Can be temporarily attached to a door or window.

1,101,058. INSULATING SUPPORTING MEANS; F. E. Case, Schenectady, N. Y. App. filed April 9, 1914. For third-rail.

1,101,059. LAG PLATE; M. G. Chase, Cliftondale, Mass. App. filed April 18, 1912. For electric meters; made of integral piece of sheet metal bent to form two hollow figures.

1,101,064. ELECTRICAL SWITCH; J. F. Dana, Jackson, Mich. App. filed March 10, 1913. For ignition circuit; plurality of disks which must be set in predetermined relation.

1,101,067. ELECTRIC INTERLOCKING CIRCUITS; W. F. Follett, Orange, Conn. App. filed Oct. 19, 1909. Interlocking apparatus for switches.

1,101,068. RAILWAY TRAFFIC-CONTROLLING APPARATUS; W. F. Follett, New Haven, Conn. App. filed Jan. 3, 1911. Electric interlocking system.

1,101,069. ALTERNATING-CURRENT MOTOR; V. A. Fynn, St. Louis, Mo. App. filed July 10, 1913. Constant-speed alternating-current motor with phase compensation.

1,101,072. ELECTRIC HEATER; W. S. Hadaway, Jr., New York, N. Y. App. filed Aug. 16, 1911. Particularly for matrix driers.

1,101,078. DEVICE FOR GENERATING A STERILIZING GAS; R. A. Kiefer, Ramsey, N. J. App. filed July 1, 1913. Liquid-containing vessel with submerged electrodes adapted for attachment to ordinary lamp socket.

1,101,095. ELECTROMAGNET; J. N. Reynolds, New York, N. Y., and H. D. Hill, Montclair, N. J. App. filed March 21, 1910. Armature construction for harmonic or reed bell used in telephone work.

1,101,120. RAILWAY SIGNALING APPARATUS; C. J. Coleman, New York, N. Y. App. filed May 25, 1909. Self-contained gas-generating apparatus for supplying gas to operate light semaphore signals.

1,101,127. ELECTRIC - CURRENT - CONTROL SAFETY DEVICE; L. T. Hatfield, Sacramento, Cal. App. filed March 6, 1911. Switches low-potential current onto line to set off signal and warn workmen on line that the high potential is about to be switched on.

1,101,133. SELECTIVE SIGNALING SYSTEM; J. L. Lyng, Yonkers, N. Y. App. filed Jan. 31, 1913. Signal of any party on the line may be operated instantaneously and selectively in response to operation of a calling key.

1,101,148. APPARATUS FOR THE PRODUCTION AND STRENGTHENING OF ELECTRICAL VIBRATIONS; J. Schiessler, Vienna, Austria-Hungary. App. filed Nov. 23, 1910. Luminous arc is used for the generation of electrical oscillations by means of a rotating magnet system.

1,101,175. AERIAL FOR WIRELESS TELEGRAPHY; E. Girardeau, Paris, France. App. filed Oct. 22, 1912. Conducting wires in two parts—an active part and a generally horizontal part.

1,101,197. MEANS FOR STARTING ALTERNATING-CURRENT MERCURY-VAPOR LAMPS; R. Küch, Hanau, Germany. App. filed May 23, 1910. Has means preventing mercury forming a short-circuit between two anodes.

1,101,201. SELF-PROPELLED WHEEL; C. F. Linderoth, San Bernardino, Cal. App. filed April 18, 1913. Electric motor incased in and geared to hollow wheel.

1,101,210. TEMPORARY INSULATOR; C. W. Potter and A. F. Van Deinse, Albuquerque, N. M. App. filed April 23, 1913. Insulating caps put over ends of service wires at the meter when the service is to be discontinued.

1,101,214. METHOD OF AND APPARATUS FOR OPERATING ELECTRIC MOTORS; W. Siebenmorgen, Westfield, N. J. App. filed July 31, 1909. Mechanically coupled armatures; gradually reduces to substantial zero the field strength of the slow-speed motor while maintaining a series connection between the armatures.

1,101.218. PRUSH-HOLDER; E. W. Stull, Milwaukee, Wis. App. filed June 7, 1909. Spring and rocker construction to give constant tension at all times.

1,101,243. METHOD OF AND MEANS FOR HEATING WATER AND OTHER MEDIUMS OR FLUIDS; G. G. Bell, Kensington, Eng. App. filed Jan. 27, 1913. Water heated in strata, beginning at the top and working downward.

1,101,251. MERCURIO-ELECTRIC FIRE ALARM; L. Cavalier, West Maitland, New South Wales, Australia. App. filed March 8, 1912. Has a bent mercury tube with one electrode submerged therein.

1,101,254. CIRCUIT - CONTROLLING APPARATUS; P. E. Collins, Boston, Mass. App. filed May 11, 1907. Electro-pneumatic timed sign flasher.

1,101,256. ELECTRICAL IGNITING APPARATUS; W. H. Cotton, Chicago, Ill. App. filed July 5, 1907. Spark plugs mounted in a valve pocket.

1,101,272. ELECTRIC SWITCH; P. E. Gilling, East Orange, N. J. App. filed Nov. 3, 1911. Detachable handle for the switch lever provided with a contact-making button.

1,101,278. APPARATUS FOR THE ELECTRICAL PURIFICATION OF WATER; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. First subjects water to electrolytic action and thereafter separates out the precipitate.

1,101,289. ELECTRIC SOCKET AND CONNECTOR; G. C. Knauff, Chicago, Ill. App. filed Feb. 21, 1913. Bayonet slot-plug connection for auto-type sockets.

1,101,327. ATTACHMENT FOR OILERS; E. H. Philbrick, Rockland, Maine. App. filed April 19, 1913. Flash-light mounted upon handle of the oiler.

1,101,360. ELECTRODE TERMINAL FOR ELECTRIC HEATERS; U. Tobler, Pforzheim, Germany. App. filed Jan. 15, 1914. Expansible joint at the point where terminal member makes connection with the heater casing.

1,101,369. RAILWAY SIGNAL; H. S. Williams and L. G. Wilson, Columbia, S. C. App. filed Aug. 31, 1910. Operates upon destruction of any part of the track structure.

1,101,370. BRAKE; J. A. Williams, McColl, S. C. App. filed June 21, 1913. Electromagnetically operated band brake using current from lighting and ignition circuits of auto.

1,101,376. LAMP RECEPTACLE; R. Abbott, Bridgeport, Conn. App. filed Nov. 13, 1912. Outlet fixture with a chamber and terminals to receive Edison-type signal lamp with the lamp lying parallel to the face-plate of the fixture.

1,101,384. ANTI-SPARKING DEVICE FOR DYNAMO-ELECTRIC MACHINES; L. R. Auvert and F. E. Ferrand, Paris, France. App. filed July 25, 1908. Surrounds ring of the rotary transformer with a metallic casing.

1,101,403. WARP STOP MOTION FOR LOOMS; T. A. B. Carver, Glasgow, Scotland. App. filed June 8, 1912. Knock-off mechanism and contacts held out of engagement with the adjacent dents by unbroken warp threads.

1,101,447. ELECTRICAL METHOD OF WELDING; E. H. Jones, London, England. App. filed Feb. 26, 1914. Uses water-cooled welding roller for pressing together edges to be welded.

1,101,448. ELECTRIC WELDING APPARATUS; E. H. Jones, London, England. App. filed Feb. 27, 1914. Water-cooled welding roller to be used as a hand tool.

1,101,452. AUTOMATIC TICKET REGISTERING SYSTEM; A. Kiparski, St. Petersburg, Russia. App. filed July 8, 1912. For totaling the number of tickets withdrawn from each ticket box.

1,101,453. APPARATUS FOR AUTOMATICALLY TOTALIZING TICKETS; A. Kiparski, St. Petersburg, Russia. App. filed Oct. 8, 1913. Prevents further issuance of a ticket from a box until the preceding ticket has been registered.

1,101,491. SYSTEM FOR PRODUCING HIGH-FREQUENCY CURRENTS; E. Girardeau and J. Bethenod, Paris, France. App. filed June 4, 1913. Has a continuous-current armature connected in series with the high-frequency discharge circuit.

1,101,494. AUTOMATIC SWITCH FOR FLASHERS, &C.; G. F. Kirchoff, Chicago, Ill. App. filed May 10, 1911. Embodies a pair of magnets with a pair of associated switches and a pair of associated dash-pots.

1,101,495. FLAT-RATE CONTROLLER; F. Kraemer, Chicago, Ill. App. filed Jan. 14, 1909. For preventing unauthorized use of current.

1,101,503. APPARATUS FOR REMOVING SNOW AND ICE FROM RAILS; D. C. Joyce, Philadelphia, Pa. App. filed Nov. 10, 1910. Electrically heated shoe for melting the snow and ice, and means for taking up the resulting water from the rails.